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March

NATURAL HISTORY

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1945

Tantalite Mining · Life on a Sunflower Leaf · Toads

New Horizons in Central Asia · California Mule Deer



books for adults

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Although this book was written to answer even the experienced woodsman's questions, the newcomer will find it a fascinating source of information concerning the methods of camping and the animals and other forms of nature encountered on a trip into the wilds. Illustrated in black and white.

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people

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by Alida Malkus

SIX GREAT MEN OF BRAZIL
by Vera Kelsey

LETTERS

SIRS:

... All five of us in my home and many of our friends enjoy the *NATURAL HISTORY*. It is one of the few magazines whose old copies we keep and treasure and refer back to from year to year.

This past year we have especially enjoyed the articles on the voyage of the "Askoy," partly because of the excellent way they are written and partly because some of the phenomena described have counterparts in Hawaii. We, too, have our wet and dry coasts. With us, too, the sea will show different colors where the depth, temperature, or other conditions vary. Off our eastern and southern shores we have seen areas something like Dr. Murphy's "dancing waters" and smooth slicks over which the sea birds hover.

The "dancing waters" as viewed from cliffs on shore appear as small areas of normal water that have been roughened with a giant file, or as if some huge sea monster were playing just below the surface and distorting the normal shoreward set of the waves.

The cause here is purported to be the inpouring of large quantities of subterranean fresh water through outlets along the steep submerged cliffs close to shore. Because of the height of our mountains and the heavy rainfall, this fresh water is said to come out with considerable force and, being lighter in weight than the salt, to rise and disturb the normal currents along shore. However, I have never been able to reconcile this explanation with the relative coldness of the fresh water, the heavy undertow that exists all along this coast, and the lack of pressure in the water in wells bored not far inland.

No explanation has ever been given me for the slicks, nor why they should seem to contain more life than surrounding areas of ocean. No explanation has been given either of the long slow swells which sometimes pile in irregular "tides" at times when the seismographs indicate no earthquakes.

If the true explanation for these is known and can pass the censor, may we have it in some not too distant issue of your magazine? If it is not known, then I think it would be fine if the "Askoy" and her staff would study Hawaiian waters more thoroughly after peace comes again.

HELEN S. BALDWIN.

Hilo, Hawaii

The following answers to the questions in Helen S. Baldwin's letter are offered by Dr. Robert Cushman Murphy, who also expresses his appreciation for her gracious remarks about his articles on the Askoy Expedition:

Two of the correspondent's questions are, fortunately, rather closely related, because they concern the pressure or weight of water and air respectively.

Hawaii has, indeed, extremely strong

contrasts between wet and dry coasts, the rainfall on certain islands being of world's-record proportions on the windward side but almost negligible to leeward. Yet I am confident that the true explanation of the "dancing water" seen offshore has nothing to do with *subterranean* water pouring into the sea. It is certain that the bulk of rapidly running fresh water on the islands is carried in *surface* streams, and that most of the water underground flows downhill only by a process of seepage.

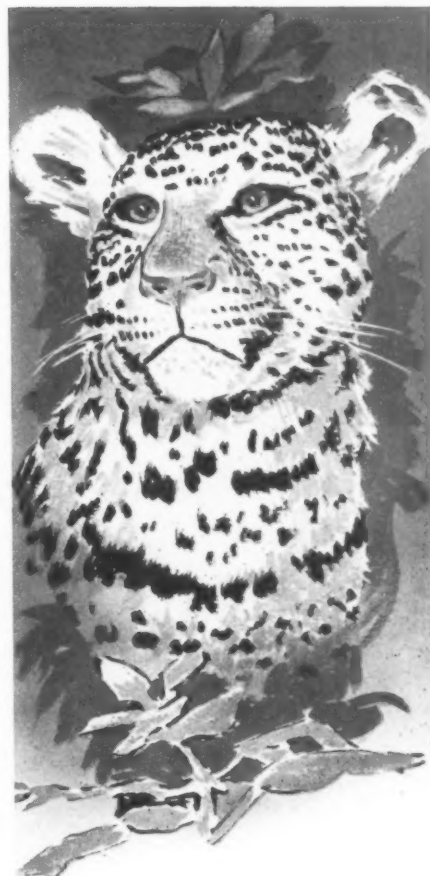
"Dancing water" may be caused by friction of several kinds, one of which results from wind whipping the surface against a tidal or other current. It may also be produced along the borders of two surface currents having different directions and densities. The latter word, which is equivalent to weight, refers to different temperatures or different salt content in the two masses of water. A third cause may be "upwelling" from a layer of deeper ocean water through a surface layer of different density. Such phenomena are possible because the ocean is made up of stable and stratified layers which, owing to their different densities, do not mix readily. Due to rapid evaporation and cooling at the surface, the relative weights of superimposed layers sometimes get out of balance or become inverted. This may result in a more or less violent overturn, of which "dancing water" becomes the visible expression.

Slicks on the ocean are usually to be attributed to living organisms. Sometimes the excreta of fish, porpoises, or whales make a microscopically thin film over a considerable area of surface. Also, the mere presence of a very large school of fish, or even of smaller creatures, has the physical effect of disrupting wave action. The resulting smoothness of the surface, when contrasted with surrounding rough water, sometimes resembles an oily slick.

The long, slow swells are related neither to local winds nor to earthquakes, but represent what are known as "barometric waves." They usually come from a distance and often pile up as enormous breakers on continental or island coasts. It is difficult to think of air as a heavy substance, and yet its weight on the surface of the ocean amounts normally to about 14 pounds per square inch. When the barometer falls, the air weighs less, and when it rises, the air weighs more. Rapid changes in atmospheric pressure therefore cause depressions or rebounds of the surface of the ocean, and these are sufficient to produce swells that travel very rapidly for hundreds or thousands of miles.

Casablanca, where our troops first landed in Africa, is a famous place for barometric swells that have their origin in middle latitudes of the North Atlantic. Before the war a regular meteorological service existed for the purpose of predicting the "surf days" on the African coast,

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The pictures in
NATURAL HISTORY
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STERLING
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NATURAL HISTORY

The Magazine of the American Museum of Natural History

FREDERICK TRUBEE DAVISON, President

ALBERT E. PARR, Director

VOLUME LIV—No. 3

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MARCH, 1945

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THE CANADA GOOSE on this month's cover was photographed by Henry B. Kane, whose outstanding work is familiar to readers of NATURAL HISTORY. This Kodachrome not only shows this fine goose to good advantage but also illustrates some of the hazards of nature photography. To quote Mr. Kane, "The shrub growing up beside the nest looks like a dead alder, at casual glance. So did lots of others sticking out of adjacent hummocks. I pulled the boat through by grasping them firmly, and held the boat still by wrapping an arm about one. Too late, I discovered they were poison sumac!"

The Canada Goose is well known as a harbinger of spring, and nature lovers in North America eagerly await the first sight (or sound) of the V-shaped flocks powerfully winging their way northward. There is no surer sign that winter is on the way out. These geese formerly nested much more widely than at present, for the opening and draining of new lands have driven many water birds to more restricted areas in the north where they may still find conditions to their liking and where they have a chance to survive and rear their young. There are some portions of the northern United States where the Canada Goose may still nest sparingly—a shadow, only, of the former vast flocks that made their summer homes in that region and even farther south.

The nest is built on land or in shallowly watered terrain, sometimes on muskrat houses or on hummocks like those shown in this photograph. It is lined with down and may contain from four to six creamy or greenish white eggs, rarely as many as twelve. Twenty-eight or thirty days are required for incubation.

PUBLICATION OFFICE: American Museum of Natural History, Seventy-ninth Street at Central Park West, New York 24, N. Y.

EDITOR: Edward M. Weyer, Jr., Ph.D.

ART AND PRODUCTION: Frederick L. Hahn.

Manuscripts should be sent to the Editor, The American Museum of Natural History, 24, N. Y.

Magazine subscriptions, Membership applications, and Advertising inquiries should be sent to Charles J. O'Connor.

COPYRIGHT, 1945, by the American Museum of Natural History, New York 24, N. Y.

NATURAL HISTORY is published monthly (except July and August) at New York 24, N. Y., by The American Museum of Natural History, Seventy-ninth Street and Central Park West. Subscription price \$4 a year, single copies fifty cents. Subscriptions to Canada, Newfoundland, and all foreign countries \$4.50. Entered as second class matter March 9, 1936, at the Post Office at New York, under the Act of August 24, 1912.

1945

YOUR NEW BOOKS

SOUTHWEST PACIFIC BIRDS • HONEY • WOLVES
LATIN AMERICA • ANTHROPOLOGY OF KODIAK ISLAND

BIRDS OF THE SOUTHWEST PACIFIC

----- by Ernst Mayr
Preface by Robert Cushman Murphy
Color Plates by Francis Lee Jaques
and Line Drawings by Alexander Seidel

The Macmillan Company, \$3.75
3 color plates, 16 figures, 316 pages

OPPORTUNITY and the man did a model job when they joined hands to produce this volume. To two and a half years of field exploration the author has added a sufficient period of laboratory research in the American Museum to handle fully the details of relationships and distribution in a manner designed effectively to assist others. For the first time, therefore, we have in a single small authoritative volume a key to the birds of the Southwest Pacific. More definitely, the territory covered includes Samoa and the Phoenix Islands on the east, westward to the Solomons, and northwestward to the Marianas, an area of continental dimensions.

Dr. Mayr's skill and experience in assembling data have assisted him in presenting his facts without needless duplication and with economy of space. Wide-ranging species, like sea birds and the largely migratory shore birds, are treated respectively in Sections I and II. The Land and Fresh-water Birds are grouped systematically in Section III and geographically in Section IV. The book, therefore, serves both as a general, as well as special guide. It tells us of birds as well as of the bird life of the islands or groups whose avifauna is more or less local or insular. This arrangement should be of much assistance to the student. Dr. Mayr emphasizes the comparatively limited amount of material he has had to work with and urges others to help fill the many gaps in our recorded knowledge of the range and habits of Southwest Pacific birds, and he gives an outline to guide us in our studies.

Three well occupied color plates, by F. L. Jaques, and about a dozen line drawings by Alexander Seidel introduce us to 50-odd species of birds that we may not have met before and thereby help in our identifications. The author dedicates this attractive book to his wife.

FRANK M. CHAPMAN.

THE SCIENCE OF MAN IN THE WORLD CRISIS

----- by Ralph Linton
Columbia University Press, \$4.00
532 pages

THIS book was planned to reveal anthropology as a contributor to the solution of world problems. Of its 21 chapters, 10 were written by anthropologists, 5 by sociologists, and 6 by specialists in an equal number of other academic fields. Without exception the anthropological authors are optimistic; the pessimists are to be found chiefly among the sociologists. Obviously the contributors were handpicked, but not all groups of research problems pursued by anthropologists are considered, the topics being somewhat arbitrarily selected. In the main, the foci of discussion are the concepts of race and minorities. Numerous slogans and warnings are sounded, as, pleas for more study of human biology to prevent world collapse; defense of the thesis that all races are born equally intelligent and of equal competence; that studies of personality will save the world; that understanding the processes of culture change and man's capacity to learn will point the way to eternal peace; that the natural resources of the world will maintain man for thousands of years, though there is danger in over-population; that the Indian problems in North and South Americas are on their way to solution; that the greatest threat to the peace of the world lies in colonial possessions, masses of "color," hotbeds of race prejudice ready to explode, etc.

If there is agreement among these 21 contributors, it is that humanity desires individual freedom, unselfish toleration, and a blind faith in the slogan that "man can make himself after any social pattern he chooses." Not all do more than hope that this is the last war and that national aspirations can be curbed. Though the anthropologists are sure that

their science can save the world, no one of them has ventured to outline a plan of action to achieve the desired ends; their plea is for more and more research in anthropology. We suspect the general reader may find the chapters more or less difficult, since a good grounding in anthropology is presupposed.

If the statements of the anthropological contributors are truly representative, they seem to imply that there is no such reality as human species behavior. Psychologists and biologists, however, usually assume the reality of "original behavior" as an important part of the environment to which culture, or human group life, must adjust itself to realize security and the "fuller life."

C. W.

WILDWOOD WISDOM

----- by Ellsworth Jaeger
The Macmillan Company, \$2.95
469 illus., 474 pages

INDIANS are always most ingenious in making tools from the things they have. Before the advent of the white man they lived off the country, successfully hunted the wild game, fished the waterways, made boats and all the equipment necessary to live a healthy life in reasonable comfort and ease. They read the trackless waste and unraveled its mystery to the early explorers and adventurers. To the friendly Indian of the past we owe our knowledge of American woodlore.

Ellsworth Jaeger is one of the few who gathered his information firsthand and spent many summers with the Indians in the United States and Canada. His activities brought him in contact with such leaders of the great out-of-doors as Ernest Thompson Seton, Dan Beard, John Burroughs, and Kermit Roosevelt. *Wildwood Wisdom* is not just another book to read but a veritable encyclopedia of woodlore, gleaned from years of experience and research. It is a book for the experienced woodsman as well as for the vacationist who plans a trip for the first time to the trackless wilds. Mr. Jaeger describes and illustrates with countless drawings all the essential requirements for the camper.

The first part of the book covers primitive and modern equipment such as clothing, shelters, beds, fire and firewood, the use of the ax and knife, and a very clear description of camp cooking with illustrations of edible, poisonous, and useful plants and trees. The second section

NATURE ENCYCLOPEDIA

Edited by G. Clyde Fisher; five volumes bound in De Luxe Green Keratol lettered in Gilt, pages are 5 1/2 x 8 inches. Lives and habits of Birds, Mammals, Fish, Reptiles, Flowers and Trees; described by renowned Naturalists; 700 illustrations, 200 in Natural color. The Literary Mart, 8 East 33rd St., New York 16, offers this set for \$7.50, remittance with order, returnable for full refund within five days.

is devoted to the crafts and skills acquired as by-products of camp life. There are chapters on barkcraft, canoes, trail blazing, animal calls, primitive tools and weapons, wildwood medicines, camp furniture; also winter life in the woods, including toboggans, dog sleds, and harnesses. Also included are diagrams showing how to make all these intricate things, and patterns showing how to make clothing from skins.

Wildwood Wisdom is written in simple direct language that will afford hours of pleasant reading by the fireside. It contains 474 pages of text, 193 plates of nearly a dozen illustrations each, a complete index, list of contents by chapters, and an alphabetical list of illustrations.

Mr. Jaeger is a skilled craftsman as well as an author and lecturer. His ambition has been to popularize nature study, and he has done this by every means available to him. GEORGE G. GOODWIN.

THE WOLVES OF NORTH AMERICA

----- by Young and Goldman

The American Wildlife Institute, \$6.00
131 plates, 15 text figures, 636 pages

THIS book of 636 pages is an exhaustive report upon the history, life habits, economic status, and control of wolves, as well as the scientific classification of these animals. The authors are senior biologists in the Fish and Wildlife Service and have had wide experience with their topics.

Stanley P. Young, in Part I, presents a well-documented account under many headings. Full descriptions of the habits and characteristics are given and are usually illustrated by field observations. The wolf has been very widely distributed, but the range has been materially reduced in historical times. Certain natural checks, parasites, and diseases control the numbers of wolves, but through conflict with human interests man has become the dominant factor in the reduction of the wolf population.

A reader familiar with the problems of Federal mammal control and the criticism it has evoked from the conservationists will scan the writings of Mr. Young with particular interest. Such a reader will be encouraged by the following statement in the Introduction: "In the more remote parts of North America, especially in Alaska, northern Canada, and on the other extreme, even in Mexico, suitable habitats remain where these large killers can exist in no direct conflict with man. No reason is, therefore, apparent to us why they should not always be tolerated, and even accorded a permanent place in the fauna of the continent; rigid control, however, must be maintained where their presence clashes with human welfare."

Major Goldman's classification of the wolves, in Part II, is a systematic review. A revision of the North American wolves has long been needed, and it would appear that Goldman's work has brought order where formerly there was chaos. He catalogues all but three of our wolves under 23 subspecies or geographical races of a circumpolar species, *Canis lupus*, the

name given by Linnaeus to the Old World animal. For three wolves found in Florida, Louisiana, and Texas, Goldman uses *Canis niger* and its subspecies. Between the wolves of the *lupus* group and those of the *niger* group, there are rather significant differences, such as smaller size and more slender proportions, as well as distinctive cranial features.

Wolves interbreed freely; they seldom encounter a physical barrier to their geographical distribution, and anyone studying the map of the 23 subspecies of *Canis lupus* might be pardoned if he wondered whether there were actually this many identifiable races. Goldman believes all of these do intergrade but states that the distinguishing features are maintained with a fair degree of consistency over areas often of considerable extent. If he is able to correlate his material and pigeonhole specimens from a given region, then he has satisfied the criteria for a subspecies. However, I suspect that a person with one or two specimens from uncertain localities might have difficulty fitting them into the proper pigeonhole.

H. E. ANTHONY.

HONEY AND YOUR HEALTH

----- by Bodog F. Beck and

Dorée Smedley

Robert M. McBride & Co., \$3.00
12 plates, 10 figures, 246 pages

FIRST published in 1938, by the late Dr. Beck, this successful book has now been revised and enlarged by Dorée Smedley. Far from being solely an invaluable eye-opener on the enormous value of honey as a health food, the authors have compiled a far-reaching, extremely noteworthy history of the honeybee and beekeeping as practiced by ancient and modern apiarists.

Among the Anglo-Saxons, honeybees supplied the king and nation with an important food, also the famous honey drink, and wax candles. But the most fertile field in which bees played a paramount part in social, economic, and spiritual life of the ancient, lay in Egypt. German archives tell of Charlemagne's domesticating wild bees in Nuremberg forests out of gratitude because, after being stung, he recovered from obstinate gout. The Nuremberg forests were the beegarden of the Holy Roman Empire, and under Charles IV, the beegarden of Germany.

India, China, Greece, France, the Island of Corsica, Hungary, Austria, and Slavic countries, all show early records of the part "man's best little friend" played in the production of honey: drink, light, and medicine. History states that honeybees were non-existent in two regions, Australia and the Americas, and were there imported. In the seventeenth century, honeybees were brought to America by English, Spanish, and Dutch settlers. In the nineteenth century honeybees were introduced into California. Today, the best honey producing areas in the United States are New York, Pennsylvania, Ohio, Indiana, Michigan, Wisconsin, Minne-

sota, and mountain areas of the West, and territory within 100 miles of Los Angeles, California. Florida is known for its Tupelo and Orange blossom honey.

Today, as of old, beekeepers may be either fixtures or nomadic. Ancient apiarists placed hives on boats and drifted along the Nile; today in United States, apiarists place hives on trucks, following the sun and blossoms to Florida and then North again to greet the summer.

ELIZABETH LINN.

THE ANTHROPOLOGY OF KODIAK ISLAND

----- by Aleš Hrdlička

The Wistar Institute of Anatomy and
Biology, \$5.00
228 illustrations, 486 pages

KODIAK ISLAND lies along the southeastern base of the Alaskan Peninsula. Together these two land areas form a connecting link between the mainland and the thin line of Aleutian Islands that reach out toward Asia. Any wave of migrants seeking an American landfall via the Aleutian causeway would, therefore, be likely to reach Kodiak and in all probability leave some evidence of their passage. Moreover, any coastal migration moving down from the Bering Sea region might be expected to touch Kodiak on its southward course. For these reasons, the archaeology of southwestern Alaska, including Kodiak Island, has always held out the promise of harboring the evidence from which a reconstruction of the settlement of the New World might be achieved.

Dr. Hrdlička began his investigation of the Alaskan area in 1926 and for ten seasons thereafter until 1938 he spent his summers, assisted by students, digging for the remains of the folk who had inhabited those regions in the past. Five seasons were put into excavating a settlement at Uyak Bay, Kodiak Island. Acres of soil were peeled off and 2,000 years of occupation were uncovered. Two principal occupations of the site were established. The first one continued for 12 to 15 centuries and is named "Pre-Koniag" by Hrdlička. These pre-Koniag people were physically quite different from their successors, and Hrdlička is inclined to associate them with Indians, in particular with the Algonquin of the eastern United States. Their culture was of relatively high artistic merit.

The Koniags who followed the earlier Indian-like inhabitants possessed a simpler and cruder culture. Physically they seem to represent an intermixture of an Aleut strain with the Indian stock of Southern Alaska. The natives found in residence when Kodiak was discovered were representatives of the Koniag occupation.

The conclusion arrived at by Dr. Hrdlička that the earlier inhabitants of Kodiak were basically Indian fits nicely the hypothesis of an Indian origin for certain strains of Eskimo, which other students have set up to explain insistent similarities.

This opus will be gratefully received by all students of native America, who
Continued on page 142



A.M.N.H. photo

▲ AN UNUSUALLY PERFECT FOUR-
POUND CRYSTAL of tantalite

By FREDERICK H. POUGH*

Curator of Physical Geology and Mineralogy
The American Museum of Natural History

SOME of the minerals that are considered of strategic importance now that we are at war are old ones whose value has long been recognized, such as the ores of mercury, tin, and nickel. Others are Cinderellas, which have been touched by a magic wand only since the war began. The need for these has far outstripped anything imagined a few years ago. Quartz, with its general use in radio communications, is one such substance. Tantalum, a relatively rare and very heavy metal, is another. As with quartz, we have had

*DR. POUGH's mineralogical activities have been partially traced in previous articles in NATURAL HISTORY. In 1933, -35, and -37 he traveled in Europe, visiting mines and mineral localities. He has recently made two trips to Mexico to observe the new volcano, Paricutin, and procured the most spectacular photographs that have been taken of its eruption. During the past year he has twice visited Brazil on mineral surveys, incidentally collecting the most notable mineral specimens that have been added to the American Museum's collection in some years. These include a new mineral of gem quality, which he named brazilianite in honor of the country.

Nature photography, particularly with flowers, is an active hobby with Dr. Pough, and he lectures on native orchids, gems, and volcanoes. He has studied at Washington University (St. Louis), Harvard, and Heidelberg.—Ed.

Tantalite— a Cinderella among Strategic Minerals

When expert mineralogists were hurriedly sent far and wide to search for one of the less conspicuous elements, the secrets of its important role in the war effort were so closely guarded that even they did not know exactly how the mineral was to be used

to turn to other nations for our supplies; and Brazil has turned out to be one of the most important sources of both these minerals.

Tantalum is an inert, heavy, light bluish-gray metal, unaffected by most acids. It melts only at 2900° C. and

is as hard as steel. Its uses are dictated by these properties. Its name is derived from that given the ore tantalite (from the Greek *Tantalus*) because it was "tantalizingly" difficult to make into a solution for analysis.

▼ JOSE MARCELINO DE OLIVEIRA, owner of the Alto do Giz, weighing \$6000-a-ton tantalite, one of the heaviest minerals

Photo from Coordinator of Inter-American Affairs



Before the war, tantalite received scant regard, and production was small. Gradually, as experience with the metal increased, more and more uses have been found for it. Some were extensions of older uses in which tantalum performs a service better than another metal; others are new ones, resulting from the creation of new compounds that demanded a substance with properties possessed by tantalum. Pipe linings and containers made of tantalum are used for corrosive chemicals used in wartime manufacturing. Radio transmitter tubes with grids and anodes of tantalum are of great importance in the small portable radios of the armed forces. Tantalum carbide is a constituent of practically all cemented carbide cutting tools. Perhaps most important of all its uses is in surgery, for tantalum has been found to be the ideal metal to take the place of shattered bone; flesh clings to it as to no other artificial substance. Today, when so much surgery of this type is necessary, tantalum is in great demand, and for many months it was the newest and most important strategic metal of World War II.

Tantalum may be derived from many different minerals, though one alone fills most of the ore sacks shipped to the Fansteel Metallurgical Corporation, sole processor under the government regulations in force today. This is tantalite, a well-known oxide mineral. It has been mined occasionally for years as opportunity afforded but was utilized principally for the other metal that it contains in varying proportions—columbium, also called niobium. As the proportion of columbium rises in this isomorphous mixture, the name of the mineral changes and it becomes columbite.

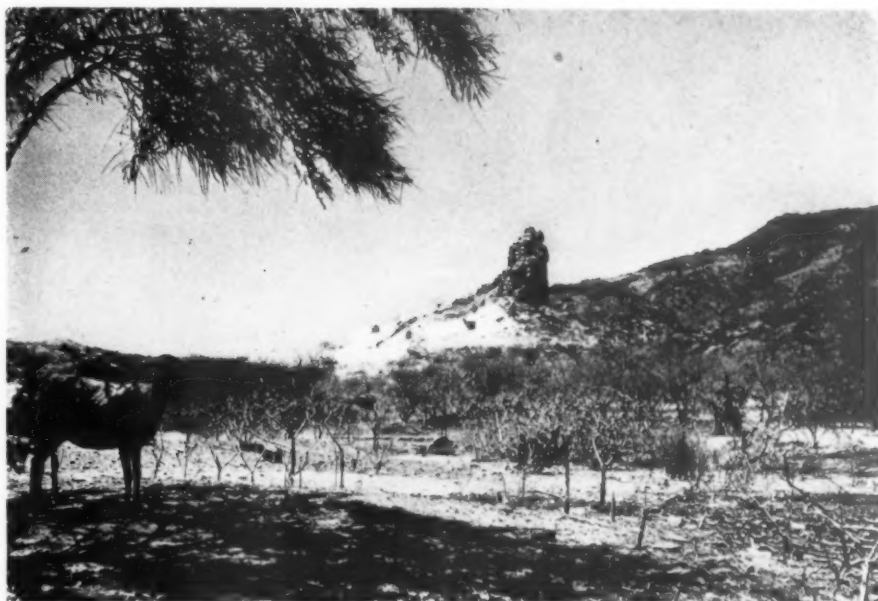
Columbium oxide is far lighter than tantalum oxide, so that measurement of the specific gravity of a piece gives a reasonably accurate determination of the relative proportions of the two oxides. A specific gravity of 7.2 means that there is 70% of tantalum oxide and 30% columbium oxide. At 6.5, each is present in equal amounts, and only the seller of tantalite knows what to call it. For him tantalite goes down to 35%, the lowest grade used for the extraction of tantalum today. To the mineral collector, anything with over 50% niobium oxide is properly called columbite.

The way in which the rocks containing columbite and tantalite were formed fortunately caused them to be



Frederick H. Pough photo

▲ TANTALITE is found in "dikes," tabular bodies that were injected while molten into fissures in the earth's crust. When weather and running water lower the surrounding land, the dikes are left standing, sometimes like walls. This is the Urubu (or Buzzard) Mine, showing typical workings and dump on the top of the hill. The level Borborema peneplain is seen in the foreground



Frederick H. Pough photo

▲ A TYPICAL WALL-LIKE PEGMATITE DIKE, with dumps around its base from prospecting attempts. Tantalite mining is highly speculative. This locality proved too poor to work. Carnauba, Rio Grande do Norte

▼ THE Boquerão Mine, on a hilltop above Parelhas, a typical *alto*, or hill, and one of the most productive in the area

Frederick H. Pough photo





Photo from Coordinator of Inter-American Affairs

▲ THE ALTO MAMOES, one of the longest of the dikes, over half a mile in length, and now proving to be one of the richest

localized in a rather conspicuous type of geological formation. They are found in coarsely crystallized granitic "dikes." These are tabular bodies that were injected while molten into fissures; and here in northern Brazil subsequent erosion of the surrounding terrain frequently leaves them standing like walls. The molten rock of which they are formed was the last of a larger mass to remain fluid. The first portions that crystallized used only the common elements, like iron, aluminum, sodium, calcium, magnesium, silicon, and oxygen. All of the rare elements remained to be deposited in the dikes—beryllium, caesium, lithium, uranium, tantalum, and columbium,—along with volatiles, like water, carbon dioxide, and fluorine. Thus the dikes contain interesting minerals built up from the molecules of these uncommon elements, scattered through a coarse matrix of large crystals of quartz, feldspar, and mica. The rocks of which the dikes are formed are known

technically as pegmatites, and the rare minerals contained in them are said to belong to the pegmatite assemblage.

The northern states of Brazil—Ceará, Rio Grande do Norte, and Paraíba—reveal some of the world's finest pegmatite dikes. Only where ancient parts of the earth's crust contain large masses of granitic rock that have been exposed through ages of erosion do we find pegmatites. And the molten mass must have been insulated and thus prevented from cooling all at once. The ancient crystalline shield that forms eastern Brazil from Ceará to São Paulo provides just such conditions. It is an ancient highland that has been elevated above sea level for many geologic periods and now almost entirely bared of the sediments that covered it for brief intervals. So we find there a wonderful exposure of crystalline igneous rocks marking the top of an ancient batholith.

When too much of the overlying material is worn away, the dikes are worn away along with the upper

layers of granite and the low places in the batholithic roof. But in the northern Brazilian states we have almost ideal conditions. Erosion has progressed just to the top of the batholith, and many roof pendants of the ancient sediments persist in the lower places of the originally undulating ceiling of the upward sloping granitic intrusion. Pegmatites are not the only economic deposits in the region. Tungsten ore, fluorite veins, and rutile deposits are a few of the related phenomena so well revealed here.

Geological conditions and agents of erosion have made the area an especially propitious country for geological work and economic exploitation, while climate has joined to make it a mineralogist's paradise. Even though but a few degrees north of the equator, high country and almost desert conditions make the temperature and humidity bearable at all times, and there is little vegetation to obscure the outcrops of the interesting formations.

The high plateau, with a base elevation around 1800 feet, is marked by many hills caused by variation in the resistance of the rocky foundation to erosion. Through the best of fortune, the pegmatites seem to be the most resistant formations, with the result that they occupy peaks of eminences or stand like walls of ancient masonry cutting across the countryside. Prospecting is easy; mining is simplified. In a country where timber is almost unobtainable and underground mining a difficult task, what could be more ideal than to find deposits that can best be worked as open cuts or simply washed from the gravels flanking the sharply rising dikes? There are difficulties in pegmatite mining, however, which will be discussed later.

There are two types of dikes in this region, and they are not unlike pegmatites the world over. The commonest, by far, are the simple, or, as they are called in Brazil, the homogeneous pegmatites, which are mineralogically monotonous and economically worthless. They are usually smaller than the valuable dikes and are composed of a mixture of the common granite minerals, quartz, feldspar, and mica, with perhaps a little black tourmaline or garnet. They are narrower than the complex, or inhomogeneous, dikes and resemble prehistoric walls in their numerous outcrops.

The complex pegmatites are rarer, though usually larger, and they are

by no means scarce. Unfortunately only a few are rich enough in valuable minerals to repay the work of mining them. Prospecting is simple. The slopes below the outcrops are tested to see if they contain any of the heavy mineral, tantalite, which is the chief object of mining in this area. Should there be found an alluvial concentration where it has been washed down from the decomposing pegmatite, the *garimpeiros* consider it indicative of the possibilities from the still intact dike. A high yield of tantalite gravel will warrant an exploration by quarry methods, but mining of a pegmatite is probably one of the greatest gambles a mining man can undertake. Many pegmatites are sampled, but very few repay the work and cost and time by giving up the heavy mineral in quantities to pay the workers and give the owner a profit, even though high grade ore sells at \$6000 a ton.

The mining of a pegmatite is unlike ordinary vein mining, and the experienced engineers who have been sent there by the American govern-

ment to assist the Brazilians in getting the maximum possible production in a limited time all swear that when they have finished the job they will never again have anything to do with pegmatite mining. The reason for this is that in vein mining there is always a definite lead to follow. The vein may grow thicker or thinner, richer or poorer, but at least every day sees some production.

In pegmatite mining there is also a definite vein to follow, but work may proceed for days, weeks, or months without seeing anything worth recovering.

When they do hit ore they may get a rich mass, as in the Alto Taboa, which not long ago produced three tons of \$6000-a-ton ore in a single mass. This particular mine has been a consistent producer and has yielded other pods with two or three tons. But between these rich strikes they go for days without seeing a speck of black in the rock. At the prices, they can afford the barren work, but few mines are so successful. Three thou-

sand tons of rock are removed for each ton of recoverable tantalite, and the operator about to give up never knows but that the next blast will produce enough to keep him going for half a year.

It is not surprising that the visiting geologist rarely sees any of the mineral. Tantalite's value is so great that no trace is left standing in the mine after a discovery. All ore is immediately cleaned out and shipped, usually the same day. There are few places in the world where one can visit mines day after day and never see any ore, though the mines are operating all the while and many of them paying well.

Other pegmatite minerals are associated with tantalite, some of which, like microcline feldspar, spodumene, and lepidolite, would also bring a good return in another country. But here, where there is no near-by consumer and transportation is so difficult, the minerals must accumulate in the dump. Only the beryl, for which about \$150 a ton was being paid when



Drawings by Museum Illustrators' Corps

▲ PEGMATITE DIKES standing up like walls and bastions on the eroded peneplain of Borborema in Rio Grande do Norte

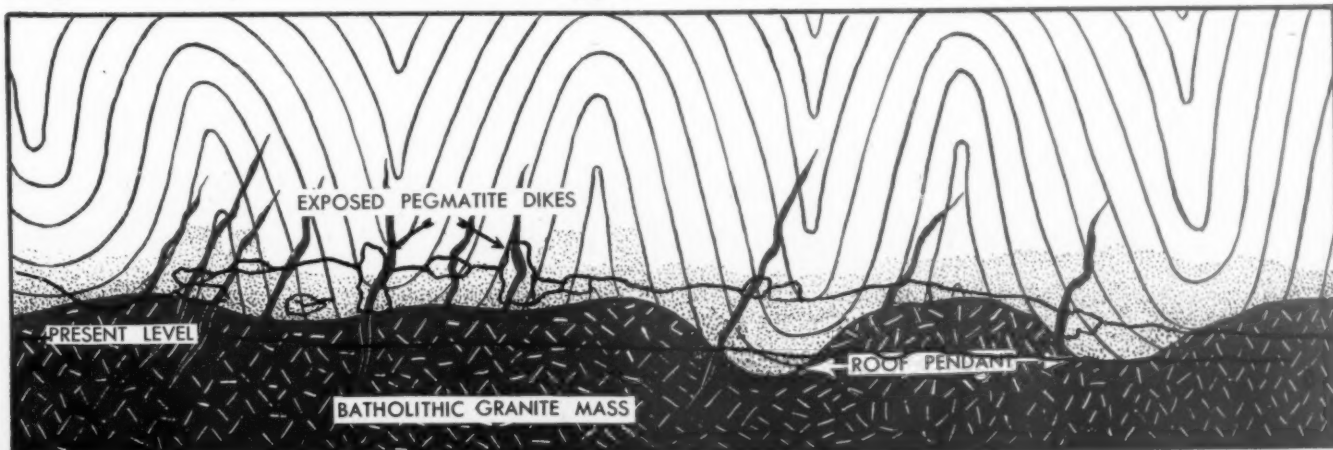
▼ HOW PEGMATITE DIKES ARE FORMED

The dark area represents a mass of once-molten rock. The projections thrusting upward from it are dikes in the making. They are highly fluid portions of the larger mass, charged with rare and sometimes valuable minerals. Pressure from below has forced them up through cracks in the partly solidified mass, into the folded layers overlying it. There they cool and harden. In the stippled

band immediately above the dark area, the folded rocks have been altered by heat and gases.

Long ages of weathering and erosion wear away most of the overlying material. The dikes are thus left projecting above the surface of the ground, where prospectors can explore and sample them for useful minerals, among which tantalite is today one of the most important.

In this drawing the present level of the ground would run roughly from A to B, depending on the extent to which the overlying material had been removed by erosion.





Frederick H. Pough photos

▲ AS MINERS excavated the material from the staked-out leases in the Malhada de Angicos tungsten mine, the original boundaries were preserved by rope markers stretched across the old surface. Several thousand workers rushed to this mine in a few months



▲ SHOWING how the barren quartz core (right) is avoided in pegmatite mining, which follows the ore-bearing areas on each side. This is the Alto do Giz, source of simpsonite and one of the oldest mines in the region

buying stopped, and a little mica, are salable. The production of beryl was many times that of tantalite, and it served as a nice profit-maker for a mine that did not pay well enough in tantalite alone. Some operators claimed that they were losing money on both and that they could maintain tantalite production only by tying in ten tons of profitable tungsten ore (scheelite) with each ton of tantalite. The scheelite represents one of the most interesting new developments of the northern mining area. It is mined from metamorphosed impure lime-

stone beds of the residual roof pendants.

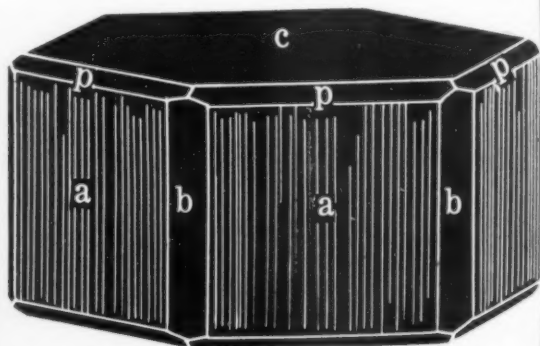
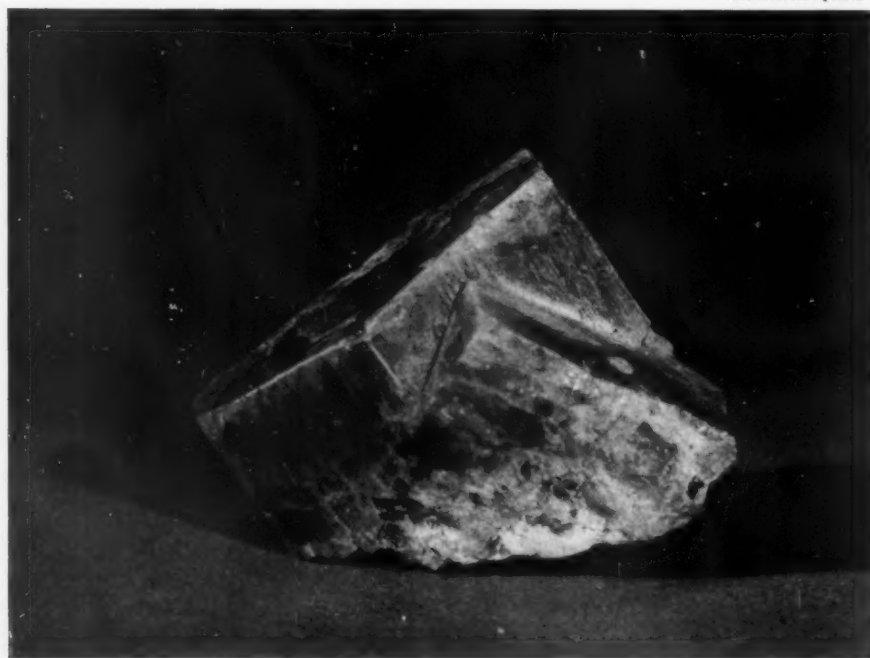
Native mining methods in the northern country are primitive in the extreme. Labor is drawn from the cotton farms in the region, and the population is surprisingly large for a land that seems so barren. There is also stock raising, and in parts of Ceará the wax of the carnauba palm is gathered.

The cotton is of the finest quality, with a long fiber that separates easily from a smooth seed. One planting about every 15 years suffices. The

plant would grow into a small tree if allowed to, but it is kept to shrub size by pruning. The maximum yield is from the fifth to the fifteenth years, and the plant may live as long as 20. Interspersed with the cotton one often sees the spineless *Opuntia* cactus, developed for regions like this where cattle feed is hard to find.

Tropical Brazil is frequently pictured as a steaming jungle with heavy rainfall, but in this section lack of

A.M.N.H. photo



▲ A TYPICAL SIMPSONITE CRYSTAL, from the first known source of measurable crystals of this rare mineral, at Alto do Giz, Brazil

◀ AN EXTRAORDINARY two-inch crystal of simpsonite from Brazil: a rare mineral first discovered in Australia in 1939 and named for E. S. Simpson, Government mineralogist of Western Australia

water is the chief problem. The rainy season comes in January and February, but some years it fails to materialize at all. Attempts have been made in some places to drill artesian wells, but little water has been encountered. An ambitious federal department, the *Inspectoria Federal de Obras Contra as Seccos*, is planning to build dams and develop large irrigation projects as funds permit, and in the few that have been completed, some of the finest gardens and rural homes anywhere in Brazil are seen. Eventually there will be many more people living in the area, with a far higher standard of living than the average there today.

The water shortage makes working the alluvial deposits a real problem. Water is carried in on donkey back and used over and over again in operating the primitive washers. A washer is seen in the photograph. Ore-bearing gravel is placed in the middle box, and water poured in the upper. A paddle works back and forth, giving the effect of a jig. The light material floats over the top of the paddle, and the heavy mineral piles up on the floor of the box, from which it is periodically removed. Most of the tantalite recovered in this way is in small fragments. The alluvial beryl, most of which has decomposed anyway, is lost.

After the alluvial portion of the dike has been worked over, mining may commence on the part still intact. Weathering has been very deep in this region, and in many cases the "alto," or hill, has been preserved by the resistance of a solid quartz core, a characteristic of many of these almost vertical dikes. Along the outer walls, there is usually a mixture of moderately coarse-grained feldspar (now often turned to clay), coarse-grained quartz, and a dark mineral, tourmaline or mica. A foot or so in from the outer edge we find a greater separation of the constituents. The quartz and the feldspar crystals have

► A PRIMITIVE JIG for separating out tantalite. Water is poured in at the top and washed down through the ore. The material is worked back and forth so that the lighter dirt floats out over the paddle and the heavier concentrate is left in the bottom. In this arid region, the precious though muddy water is used over and over



Frederick H. Pough photo

▲ LOOKING DOWN UPON Parelhas, a typical small town and local center of mining in the dry interior of northeastern Brazil. In the foreground are beautifully tinted outcrops of rose quartz

become much larger, and with them are the valuable minerals. This band may be six or eight feet thick, sometimes more; and it frequently abuts against a barren core of solid white or rosy quartz which may be as much as 20 feet thick. Then the succession, in our ideal pegmatite, may begin again and continue to the farther wall, making a dike 50 or 75 feet through. These pegmatites are longer

than those we know in many other areas. The Alto Mamoés, for instance is over half a mile long. Most North American pegmatites are measured in terms of a few hundred yards.

The primitive mining methods result in the dumping of refuse without regard to future operations and the creation of dangerous working conditions by digging under overhangs. But the United States Government

Photo from Coordinator of Inter-American Affairs



has attempted with great success to increase production by supplying technical advice on the soundest methods of operation. Machinery has been supplied, money lent for payrolls, and roads built so that the ore can be more conveniently shipped out and machinery brought in. Tantalite production increased several hundred per cent during the two years that this program has been in operation.

Experience has shown that the pods of tantalite are most likely to occur near the margin of the quartz core and in the coarsely crystalline altered feldspar. Although the feldspar in some of these deposits is largely altered to clay there is still enough hard quartz and fresh feldspar left to make the work difficult and to involve considerable blasting. The greatest physical contribution of the North Americans to this work came in the form of air compressors for drilling the holes for blasting. These greatly increased the speed with which a stretch of dike could be opened up.

Beryl and tantalite are carefully picked out by hand and promptly carried to the hut that serves as mine office. Beryl may be piled up outside, but the tantalite is stored in locked chests. When enough has been accumulated, it is shipped off to the nearest buyer, who may pay \$2.50 to \$5.00 a kilo (2.2 lbs.) for it, depending upon the value that experience has shown him should be put on the ore from a particular mine. This ore, purchased from many little producers, is periodically shipped to the railhead and export center, Campina Grande in Paraiba. There it is reworked by careful crushing and washing in gently sloping conical pans, after which it is sacked and shipped to the United States. Over 90% is said to pass through the hands of Silveira Dantes of the Silveira Brazil Company, the principal producer.

Beryl, too, is reworked at Campina Grande, because feldspar, quartz, and tourmaline are often intergrown with it, sometimes inside the very crystals. The beryl is broken up by a hammer into fist-size chunks, sacked, labeled, and shipped in the same way as the tantalite. The tungsten ore comes in almost as a sand, but it, too, is usually reprocessed by the same simple hand methods and sacked for shipment.

The refractory nature of the compounds of tantalum make them min-

eralogical problems that the chemist is loath to tackle, and the relative rarity of the ores has meant that few samples have been available for study. One would think that with the present production, many fine specimens would have been collected, but this phase of the work has regrettably been neglected. Most of the men, both the Brazilians and the North American engineers, are little informed in mineralogy and have not appreciated the importance of collecting typical samples and all unusual varieties in as large, unbroken pieces as possible. Hence, a fine opportunity has largely been lost, and only an occasional specimen has been spared by some discerning engineer or buyer who took the trouble to keep it intact. Still fewer specimens have got into the hands of competent mineralogists, who would appreciate their importance and save them until happier world conditions might permit a detailed study of the Brazilian ores. For tantalite is not the only Brazilian tantalum mineral; there are many others.

The most interesting is probably simpsonite, a little-known and poorly described hexagonal aluminum tantalate, first found in Australia in inconspicuous, partly altered crystals. A strongly kaolinized dike known as the Alto do Giz, in Rio Grande do Norte, has produced the finest crystals of this mineral ever seen, better even than those from a second source recently discovered in Africa. The sharp, fresh looking, six-sided crystals of the Alto do Giz are yellow-brown in color and well developed. Unfortunately, none were saved in aggregates; perhaps, indeed, none were found this way. However, fine loose crystals were found in several places and will serve for crystallographic work.

A few broken fragments of a heavy white mineral were seen in the town of Equador at the office of the owner of this mine, Jose Marcelino de Oliveira, and X-ray examination has shown that this white mineral, too, is simpsonite. Before they were broken, they must have been of considerable size, several inches across. Associated with the brown simpsonite crystals are many tiny green octahedra which proved to be microlite, a calcium tantalum oxide and one of the commonest of the tantalum minerals.

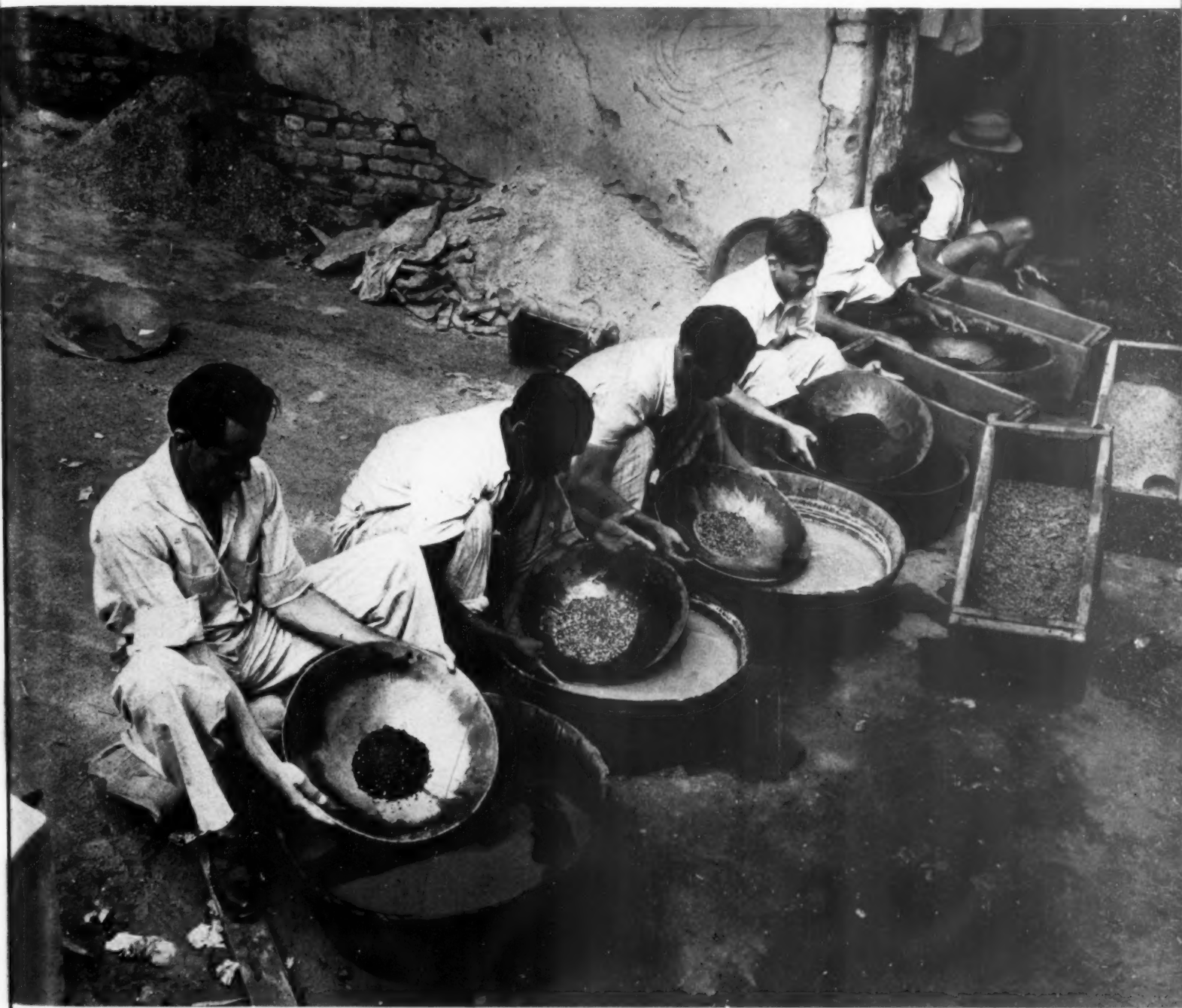
Columbite occurs at this mine, in

black orthorhombic crystals, and there are also some small but sharp reddish-brown crystals of what seems to be manganotantalite, a manganiferous variety of the commoner, usually black mineral. Large crystals of manganotantalite were seen from many mines, most notable from the neighboring Alto Mamoés and the Varzea de Vassoeira. A very rich and interesting mine not far away across the hills, but many miles by road, is Onça Mine, where a rare black tantalum mineral tapiolite, is veined by white streaks of an alteration product, for it is changing to microlite. Simpsonite is said to have been found at this mine, too, and the crystalline masses coming from there show other crystal faces from those of the Alto do Giz and look quite different.

However, it will be some time before all these interesting minerals can be studied, and at the end of November purchases of the too expensive tantalum were stopped because considerable stock-piles had been built up in this country and because African and Australian production had increased.

During my journeys in the region, travel in the desert states was greatly facilitated by the work of the United States Commercial Company, a branch of the FEA; and the houses maintained by the staff of their engineers made a pleasure of what would otherwise have been arduous and uncomfortable work. I am greatly indebted to the division engineers E. H. Page and his successor James E. Moore for their help during my studies in the area.

The secret of much of Brazil's production of strategic minerals lies in the fussy, painstaking, and time-consuming work that is performed by poorly paid laborers, whose standard of living is far below the North American scale. Even now, poor as the wage scale is, much of the tantalite is produced at a very low profit. Clearly the mines could not be worked if wages were much increased, without a great rise in tantalite prices. Perhaps one should expect to pay more for this valuable metal. Certainly anyone who has seen the poverty of the miners and the terrible gamble the operators take feels that tantalum is one of the valuable substances of this earth, hard to find and hard to work, and surely worth more than the higher prized but more abundant metals like silver and gold.



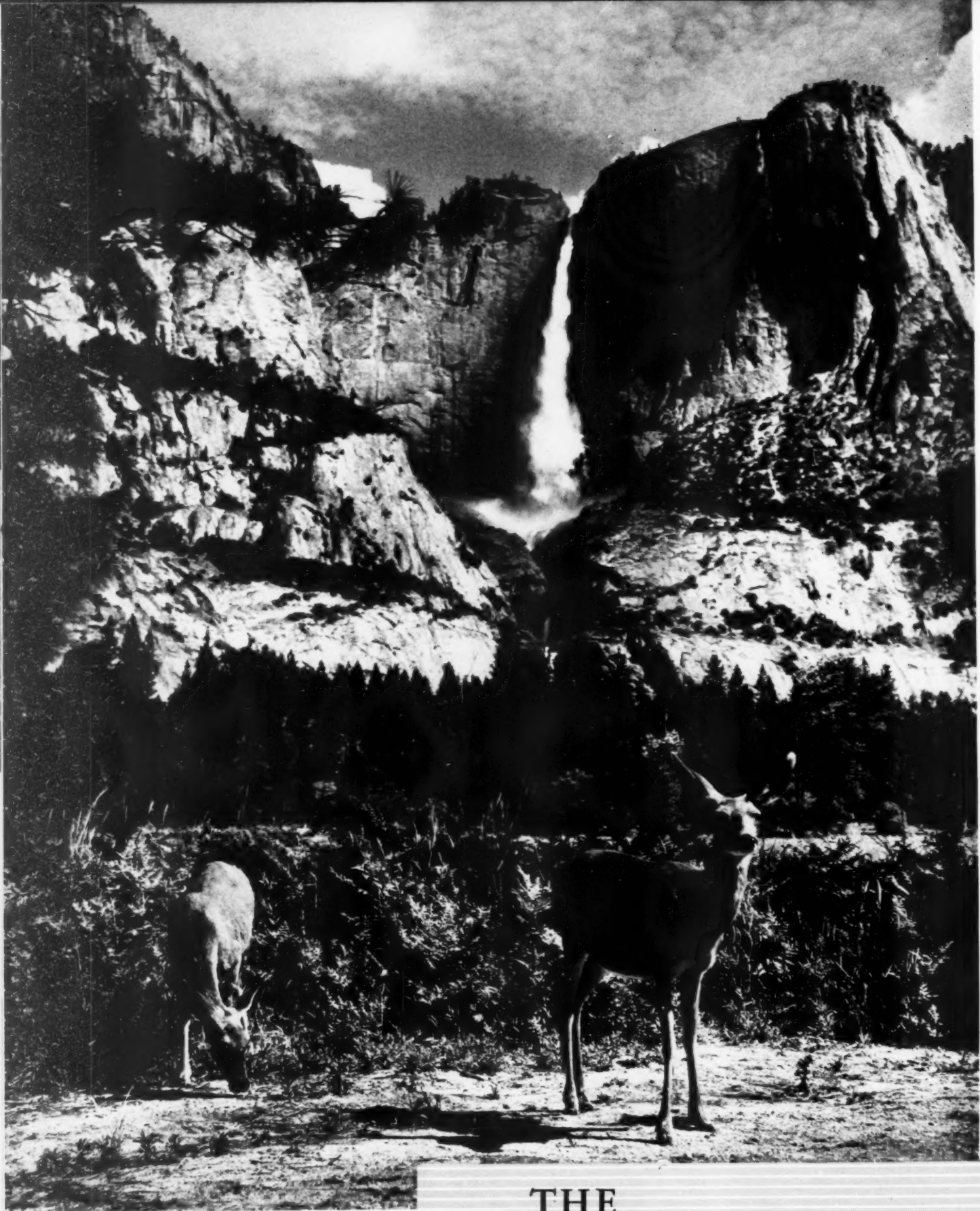
▲ **REWORKING tantalite and tungsten ore by hand-washing at Campina Grande. All the ore is reworked thus before being sacked for shipment**

Photo from Coordinator of Inter-American Affairs

Frederick H. Pough photo

► **THESE FINE GRAINS of tantalite are the result of rewashing tons of fragments from the old dump. Disappointments are many, but the lure to prospect new dikes is strong, for the discovery of a rich "pod" sometimes repays months of barren work**





▲ THE YOSEMITE FALLS provide the background for this scene, but California mule deer are apt to be seen in many places along the western slopes of the Sierra where timber or brush offers concealment. They are called mule deer because of their long ears. The upper surface of the tail has a black line and white edging, and is longer than that in coastal black-tailed deer

THE
California
Mule Deer

By

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in

By JOYCE and JOSEF MUENCH

► ALL THE STRENGTH and alertness that are typical of the California mule deer are found in the posture of this grand old buck of the mountains. When startled, the animal launches himself into the air with all four feet, as though propelled by steel springs, clearing bushes and low trees as he bounds off in rapid flight

▼ A YOUNG BUCK caught by the camera in his native woodland. Summer finds his antlers still in the velvet. This covering of thin skin and soft hair will be shed with the coming of fall and the mating season. Early in spring the hardened antlers will be shed





◀ THE GENTLE EXPRESSION in the eyes of the mule deer gives little indication of the powerful, explosive action of which the animal is capable



◀ DURING the mating season (October to December) the male collects as large a harem as his strength permits. After that he leaves the does and joins the other bucks, usually in lower ranges where food is plentiful. They do most of their feeding early in the morning and late in the evening, or even by moonlight

A toad is like *THIS*

By

ROY L. ABBOTT

Iowa State Teachers College

Photos by

HENRY B. KANE

Strange things happen when the little defenseless tadpole forsakes its slimy pond for a life on land as a complex and effective organism



1 IN THE MIDDLE OF A HOP: a toad leaping. Note that the fast camera caught the animal with its eyes shut

IN the dampness and dense shade of the great rhubarb leaf, the toad sat half-buried, her brown, warty skin blending imperceptibly with the crumbly soil. Now and then some big black ants hurried across her broad back, but except when one chanced to pass an inch or so in front of her head, she gave them no attention, for the sun was yet high, and although she couldn't resist snapping up any small fry that came within range of her quick tongue, she would not set out on any active hunting until sundown.

Not that the toad wasn't hungry. Except when hibernating, she was always hungry, and now particularly so, for she had just returned from a two-weeks' pilgrimage to a near-by pond where she had deposited her first eggs—some five or six thousand jelly-covered, shot-sized things left there to hatch and shift for themselves as best they might.

The toad had spent nearly all of

her four years in this garden, and, save for the long journey just completed, had never once left it. The egg-laying trip was a new experience, a response to new urges, such as the high, shrill voices of male toads calling from the pond, and the quiet but equally insistent pressure of the many eggs in her body—the voices, as it were, of potential toads clamoring to be born.

The toad herself had begun life in this same pond. But now, squat, pop-eyed, four-legged, and nearly as large as a man's fist, she looked little like the chuckleheaded fishy mite who, along with several thousand others, had wriggled free from the gelatinous, rosary-like egg-strings left there by her mother.

In fact, at that early age, the toad was really a fish, for she breathed air from the water through delicate, feathery gills on each side of her head, and propelled herself by means of a broad tailfin. But, strangely enough,

she was a fish who couldn't eat, for her mouth had not yet broken through into her intestine, and until that necessary thing occurred some six days later, there was little for her to do except to cling to some water weeds by means of a pair of head suckers, or to make short, wriggling journeys from one plant to another. But when her broad-lipped mouth with its two rows of teeth above and three below finally appeared, she and the rest set out with ravenous appetites to make up for lost time, scraping the tiny green plants from their supports, biting off fragile, tasty bits from the ends of larger ones, and even sucking in minute animals from the ooze at the bottom or the slime at the top. If a dead fish or a worm was found, she joined the hungry crowd about it, shouldering the rest aside and holding her place at the feast by sheer muscular power until sated.

As a result of all this food-taking she had grown mightily. By the end



2 NOTHING MOVING, NOTHING EATEN. The toad strikes only at a moving object

of six weeks she was an inch-long tadpole, black in color with a fine stippling of gold, and breathing now by internal gills instead of the external ones, which had disappeared.

And at this juncture, strange things began to happen to her. Upon each side where her tail joined the body, rounded buds of flesh protruded themselves and grew steadily backwards—the beginnings of her hind legs. Soon joints appeared in these stumps, then toes and feet, and she then began using her newly formed legs along with her tail in swimming. Meanwhile, internal changes were also occurring. Her long intestine, coiled like a watch spring, began to shorten. And from the front end of her food tube two saclike growths appeared and pushed backward. These were lungs. They were to fit her for land life, and since her internal gills had already begun to fail, she was even then using these new organs, gulping them full of air at every trip to the surface.

Seemingly, she was to have no front

legs. But two weeks after the formation of the hind ones, the front pair appeared suddenly. Quite ready for use, they broke through the gill coverings which had concealed their development, and now for the first time, the embryonic toad really looked like a toad. For even before her front legs appeared, her head had changed greatly. Her tiny mouth had been replaced by a huge one, its wide opening extending far back under her eyes, which in turn had become large and elevated and covered with lids, and which appeared bright and beautiful as a toad's eyes should.

But for all these transformations she was still a rather strange creature—a toad well enough, but a toad with a long fishlike tail. Nature soon disposed of this incongruity, however, by allowing her to resorb the tail and use its materials for other purposes. So, freed at last from all semblance of a fish, she was now a complete toad in all respects except warts; they were to come later.

With the loss of her tail, the toad left her pond, with her several thousand brothers and sisters. That is,

with those who had come to real toadhood. For although the sticky, jelly covering had protected the eggs well enough for most of them to hatch, the tadpoles had been less fortunate. Once outside the protective jelly, a host of predators had assailed them. Hundreds perished in the masked jaws of ferocious dragonfly larvae, other hundreds were sucked dry of blood by the grooved fangs of the water tigers; and the piercing beaks of the pearl-colored backswimmers had taken a great toll. To say nothing of those gobbled up by the bullheads and the snapping turtles and by the wide beaks of ducks, shoveling the mud of the shallows.

But in spite of all this, when the toad left the water, a whole army went with her, a host of fleshy, cricket-sized mites, hopping hopefully into the wet grass, each in search of a corner in which to live. Many never found that corner, for outside the water there were hungry grackles and hens, and minks, and frogs, and—one of the worst of all the toad's many enemies—the garter snake.



3 THEN THE AMAZING TONGUE, attached in front and free behind, flashes forth

Yet day after day, still managing to escape the fate of her fellows, the toad hopped farther and farther from the water, until she came at last to a place where there was soft earth, and cutworms, and leaf hoppers, and lettuce and radishes, and wide, shady leaves of rhubarb. Here she settled down to live.

Thus the toad came to her garden in the spring.

The garden was the toad's universe. It was a tiny one, but as she prowled it of evenings or early mornings, she became increasingly aware of its texture and problems. It was a universe comprehended in part through her skin, which told her of variations in temperature and moisture, of things rough or smooth, and of those pleasant or painful to touch. As a tadpole, food had often meant a thing of odors; now these played little part in her life. When she did show discrimination, in either taste or smell, it was usually only to reject—sometimes when half-swallowed—certain noxious or foul-smelling bugs. Likewise, her ears told her that

sounds played a part in the world. The singing of a cricket brought her a certain emotional and muscular awareness manifested by the quick cocking of her head or a slower rate of respiration.

But most of all, the toad's world was one of objects, of things seen. Her great golden, black-centered eyes gave her sharp images of the medley of forms around her—the plants, the gardener, the dog, garter snakes, other toads, and a whole assemblage of crawling things, the earthworms, the snails and slugs, and the insects. The toad's daily life was chiefly a complex of responses to these and to things felt through her skin.

Each evening, when the sun had dropped below the western rim and its glare had gone from the earth, the toad emerged from whatever leaf or cranny had concealed her during the daylight hours, and set forth upon a round of the garden. Hunger was the impelling motive of these nightly quests, but she always started off slowly, as if she knew that game was plentiful and that she had plenty of

time. After a succession of short hops she would stop dead still and peer keenly about. When prey was sighted, she moved quickly toward it, her gait often changing to an awkward crawl as she drew near. If at the instant she was ready to strike a caterpillar, it suddenly decided as a defensive measure to curl up and play dead, the toad waited patiently until it again showed signs of life. Sometimes, indeed, she gave it up entirely as a dead thing and moved in search of something alive and active. For no matter how hungry she might be, she never struck at a non-moving object. The creatures upon which she fed, of course, didn't know of this strange "nothing moving, nothing eaten" peculiarity of the toad. Hence, when one moved, ever so little, within two inches of her head, her mouth would open, and her marvelous tongue—fastened at the front and free at the rear—would flash forth with the speed of a striking snake, its sticky surface winding about the victim and drawing it swiftly into her wide mouth.



4 THE TONGUE'S STICKY SURFACE captures the prey, and . . .

The toad had no teeth, hence everything entered her stomach in the same form it entered her mouth. The swallowing process, unbelievably enough, was greatly aided by her eyes, which invariably rolled deeply inward and backward during the act, thus forcing the struggling creature into her broad gullet. The number of animals captured of a night depended, of course, upon their size. She could swallow 50 ants or more without discomfort, whereas three or four average-size earthworms or several June beetles would temporarily gorge her to repletion. But her strong digestive juices worked rapidly, and if food was plentiful, she often ate enough to fill her stomach completely four times in 24 hours.

The toad's days were much alike. In her life there was probably little joy and little pain, but now and then came something to interrupt her quiet round of living: the gardener or his dog, for example. The gardener often dragged her bodily from her shady retreat to watch her sleepy eyes blink

in the blinding sun. Sometimes, too, he carried her to the screen door and laughed as he held her in his hand, watching the house flies disappear like magic to the Lilliputian whipcracker reports of her flashing tongue. Sometimes he teased her by tickling her nose, chuckling gleefully as she lowered her head and butted clumsily at the offending straw.

The gardener's dog, also, now and then diverted himself with the toad by fishing her from the soil and barking and poking at her gingerly with tentative paws.

Often she inflated herself hugely as he mauled her, behaving as she did when a small garter snake attacked her. Sometimes, when overturned by his quick paw, she would play possum, lying belly up and quiet as if dead, even her breathing seemingly suspended. Once, when the dog had hurt her with his teeth, she had shown him one way a toad protects herself by giving off into his mouth a whitish fluid from the big glands on the back of her neck, and the memory of its

awful taste had taught him never to take her in his mouth again.

The extreme heat and dryness of summer also affected the toad. She never drank in the manner of other animals; all the water her body required had to come to her through her food or directly by absorption through her skin, this last chiefly from wet plants or the damp soil. Also, since she was cold-blooded, her body warmed or cooled with the rise and fall of the temperature of the earth and air about her. Hence, hot, dry air and dry soil took water rapidly from her skin and made her miserable, so on such days she burrowed deeply to come to the earth's dampness, and remained hidden until the sun was well down and the dew had fallen.

Four times yearly there came another interregnum. This manifested itself to the toad's awareness by a sort of general tightening and pulling and constriction all over her body, as if her outer skin had become dry and shrunken. This told her that the moulting period had come; so to rid



5 THE TIP of it returns to the back of the mouth, and with it the caterpillar

herself of her old skin, she would sit with her back strongly arched, head bent downward, and feet drawn under her body. Her outer skin, already loosened beneath, would then split along the midline of head and back and belly, next from side to side at her rear, and lastly from arm to arm across her breast.

After the skin had split along these lines, she freed her hind legs from their covering by bringing them forward and then rubbing them forcibly backward against her belly, all the while opening her mouth widely and expanding her body in a kind of shrugging motion. The whole effect was to drag the loosened skin forward to the corners of her mouth where it was still attached and gradually sucked in. Next she would drag her front legs free, and then after a few prodigious gulplings she would swallow the skin all in one piece as the final act of the moult. Then as her discomfort passed and her new skin dried and darkened, she would sit erect once more, open her eyes widely,

and go on about her living as if nothing unusual had happened.

Each year, usually in October, the toad found herself heavier and slower and sleepier, with less desire to eat, and pervaded by a vague uneasiness. Unknown to her, the fat of her body, a product of her many nightly feasting, had piled itself into two huge orange-colored masses near her kidneys, and sugar from the same source gorged her liver. The fat and sugar were her food reserve. Some of it would be built into the eggs she would lay in the spring, some would be slowly burned to warm her as she slept. For the time had now come to hibernate.

So, just as in summer she had burrowed backwards into the soil to avoid the heat and dryness, she now backed even deeper into an old burrow or, mayhap, even into a new one, to avoid the frost, boring deeply backwards and downwards until the earth dropped in and covered her head and half-filled the entrance, this later to be plugged yet further with leaves and snow.

Here she slept. As the days grew colder, she grew colder until she was stiff and insensible to her surroundings but never quite frozen. Her heart slowed until her blood barely moved through the vessels; the fires of her life burned low but never quite went out. She was sleeping against time—against the coming of April. Then, when the red-shouldered blackbirds were singing in the swamps, when the cowslips yellowed the meadow, the ferns were unrolling, and the new red leaves of the pond lilies were struggling upwards, she would awaken from her trance, come forth from her cell, cock her head, and listen once more to the shrill voices of male toads calling from the pond.

Then, too, possibly because of these voices and the pressure of the many eggs within her, she would journey again to the pond, place her eggs there in the water, and without once thinking of their further welfare, return again to her home in the garden. This is the way of the toad.

Upon this tiny stage, strange insects, with a brutal but effective precision, enact an even stranger drama of life—and death

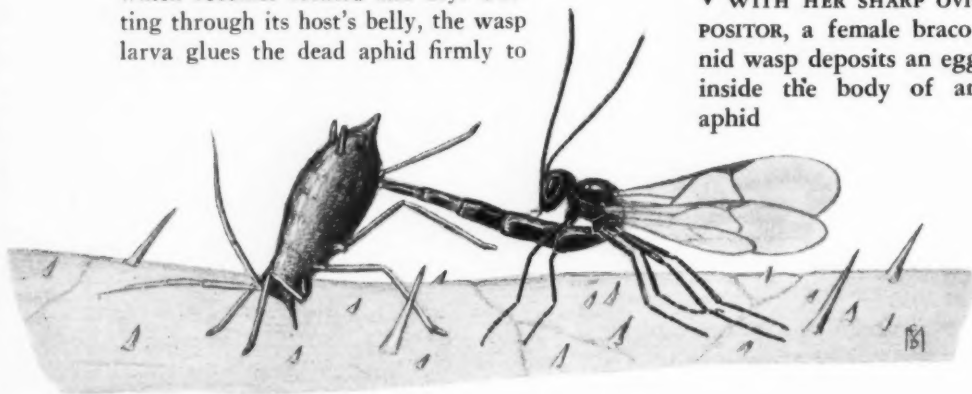
THERE is a sudden movement among the sluggish aphids. Several of the fat plant lice are rearing their bodies up and down in vain efforts to avoid a hurrying black menace. The enemy is a female braconid wasp no larger than the letter i. As she runs about she frequently stops behind an aphid to tap it with her rapidly vibrating antennae. If the aphid is suitable, she rises high off the leaf surface on her legs, curls her abdomen forward between them, and with her sharp ovipositor drives an egg into the body of the aphid. Then away she flies, leaving the aphid to return to its monotonous sucking of sunflower plant juices apparently none the worse for the stabbing.

In a very few days, however, the wasp egg becomes a larva which proceeds to eat the aphid alive from within. It is death for the aphid, which becomes bloated and dry. Cutting through its host's belly, the wasp larva glues the dead aphid firmly to

an aphid already is housing an egg or a larva, or it may be that only one larva can survive in case two or more eggs happen to be placed in one aphid.

All this occurred on a large leaf of a sunflower plant (*Helianthus annuus*) just outside our back door in Pasadena, California. The leaf is about midway up the stalk, green and as yet almost unblemished except for a slender, pale, serpentine streak which we recognize as the work of a leaf miner. The leaf miner, a tiny fly larva, left a narrow trail at the beginning, but we can see that it broadened as the growing miner ate its way between upper and lower surfaces of the leaf. At the broad end there is a pale blotch where the larva stopped to pupate, and in the lower epidermis of the leaf we see a tiny tear through which the little fly escaped.

▼ WITH HER SHARP OVI-
POSITOR, a female braconid wasp deposits an egg inside the body of an aphid



the leaf. Its meal finished and home made secure, the larva draws back inside and rests for several days as a pupa. From this resting stage the wasp emerges as a winged adult ready to leave its aphid house. It cuts a neat round hole through the upper surface and crawls out. The disc cut out often remains weakly attached at one side like the lid of a tin can not quite cut free.

Now we see that in the aphid colony on our sunflower leaf there are many brown and bloated skeletons of parasitized aphids. Sometimes whole colonies of plant lice are destroyed by these braconids, but on our sunflower leaf less than five percent of the aphids have been parasitized.

Apparently only one wasp ever emerges from any one aphid. Perhaps the mother braconid can tell whether

These aphids (or aphid) are known as sunflower aphids (*Aphis helianthi* Monell), a dark green or greenish black species especially common on this plant in southern California in the late summer. Some parts of the leaf are almost covered with them.

Exploring for a new homesite, a few winged aphids from another plant arrived on this leaf during the summer. Here they settled down to rear families. One by one the babies are born, active little nymphs, each looking much like its mother except for smaller size and lack of wings. We do not see the eggs, for they hatch within the mother's body.

All these youngsters are daughters, plump and green, who will never have wings. And strangely enough, all of these daughters are fatherless, for the mother aphid is able to produce young

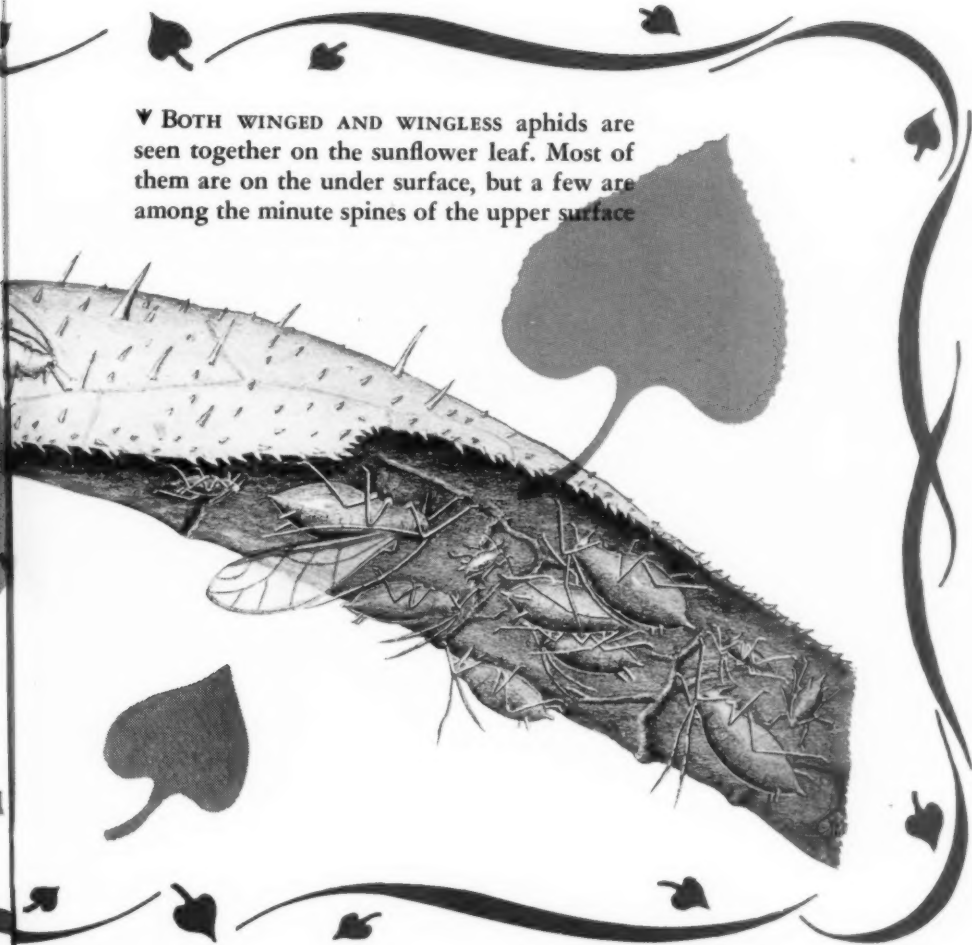
Life on a Sunflower Leaf

By CHARLES D. MICHENER
and
MARY H. MICHENER

without mating. This process is called parthenogenesis. It is only in the fall of the year after numerous generations of females that, in most species of aphids, some sons are born to grow up and father the next generation. The eggs fertilized by these males do not hatch in the body of the female but are laid and survive the winter unhatched. Of course, our sunflower plant is an annual and will not be able to support the aphid families during the winter and next spring. In the fall, winged females leave the sunflower and fly to other plants on which the species can winter, perhaps only as eggs. The sunflower aphid in some places winters on dogwood, a plant which, however, is very scarce where our observations were made.

Looking closely at the sunflower leaf we see that both winged and wingless aphids are present. It seems that winged females are produced not only for the fall migration to a different species of plant but also from time to time in the course of the summer generations. Just what the needs or stimuli for the production of winged individuals might be, science does not yet fully understand, but these are some of the conditions that

▼ BOTH WINGED AND WINGLESS aphids are seen together on the sunflower leaf. Most of them are on the under surface, but a few are among the minute spines of the upper surface



may influence it. There may be overcrowding in the aphid community and some will develop wings and leave, or the sunflower plant may weaken from disease or from the draining of its juices by the aphids themselves or poisoning from injected salivary substance. There is no carefully planned food rationing here; some must die or shove off and look for greener pastures. And in such emergencies nature issues wings to some to enable them to travel.

Life is just one long drink for an aphid. Its "cider" is plant juice and its "straw" a special arrangement of four slender mouthparts or stylets, which are enclosed in a heavy sheath when not in action. The stylets taken all together are far more slender than a human hair, yet they can penetrate plant tissues and they enclose a pair of tiny channels. Through one of these channels juices are sucked, and through the other saliva is injected into the plant.

After proteins and other food elements have been strained out of the plant juices in the aphid's body, the remaining sweet fluid is excreted through the anus. This liquid is known as honeydew, a soft drink

much favored by certain ants and other insects. Just how the aphid's inside filtering system works we do not know, but it is clearly associated with the unique arrangement of the intestine characteristic of the Homoptera, the group of insects to which aphids belong. The gut (a perfectly respectable term in scientific circles) is looped back upon itself so that a very thin portion of the wall adjoins an equally thin wall of the fore part of the same tube. We may suppose that much of the water and sugar in the plant juice passes through these thin walls, taking a short cut to the anus, while food substances scarce in the plant juice but needed by the aphid are sent the full length of the gut,

where they are digested and assimilated.

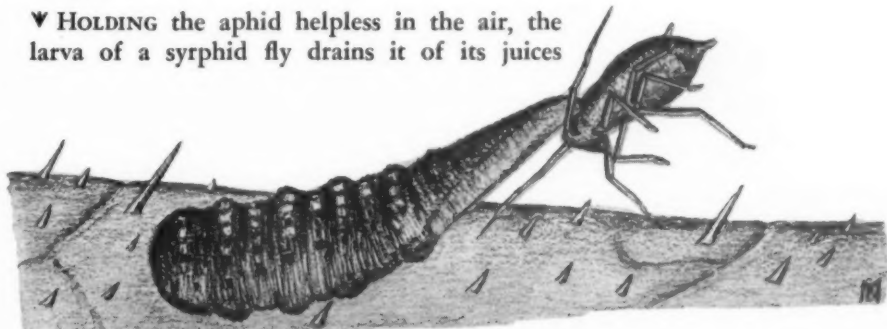
Honeydew is produced in great quantities, covering a large part of the leaf surface and providing food for many insects. It also serves as a nutrient medium in which various molds can grow. That dark band of little Argentine ants (*Iridomyrmex humilis* Mayr) which is flowing up and down the sunflower stem and branching out on each leaf petiole is in search of honeydew. We can see that each ant collects the fluid directly from aphids, its antennae patting each little "cow," apparently to induce it to excrete a drop. At once the drop is taken up by the ant. Abdomens of ants leaving the sunflower leaf are often noticeably paunchy compared to those of new arrivals, for ants store honeydew in their crops to carry it home to the nest.

Other visitors come to the bountiful syrup spread, such as stunning blue-green cuckoo wasps and the males of black and yellow wasps of the genus *Crabro* with their forelegs oddly expanded into large shields. These do not gather from the aphids directly but lap the honeydew from the leaf surface.

We have already seen that the braconid wasp (*Lysiphlebus*) is an insect that uses the aphids for its own benefit but, unlike the honeydew eaters, destroys the aphids. Another wasp that takes considerable toll of aphid lives is *Stigmus*, five or six times as big as the braconid but nevertheless under three-eighths of an inch long. It is black with a heavy squarish head. *Stigmus* does not parasitize the aphids but preys upon them as food for her young. In some near-by dead and broken stem she tunnels out a nest for her larvae. When the burrow is complete, it is stocked with an abundance of fresh aphid meat. We can watch her collect aphids from our sunflower leaf. With her jaws she grasps an aphid, stinging it almost at the same moment. Then she flies

Continued on page 144

▼ HOLDING the aphid helpless in the air, the larva of a syrphid fly drains it of its juices





A vast land whose problems are lack of irrigation and transportation rather than man-power, stirs with the desire for a place in the modern world and gives promise of rapid progress

IN the heart of Asia lies a vast and remote area, approximately the size of our own United States, which for thousands of years has remained little known and little touched by the outside world.

I entered this land with my companion, Major William J. Morden, after two months of trekking over the Himalayas and the high Pamirs of Russian Turkestan. We dropped down through rugged gorges and were welcomed at the border by couriers dispatched by the Chinese Governor to meet us. As darkness fell amid a threatening thunderstorm, we galloped ahead for the nearest habitation, leaving our caravan to follow.

Riding rough trails at dangerous speed, I could see nothing in the utter blackness, not even my own horse beneath me. My only guide was the sound of hoofs ahead and the occasional sparks cast by their iron shoes.

Flashes of lightning weirdly outlined rugged canyon walls, giving me glimpses of my companions ahead. In this intermittent blue light and amid the peals of thunder they were strangely like the Four Horsemen riding into a valley of death. Far below me to my left I caught the occasional glint of a mountain torrent. One misstep of my horse could plunge me to unknown depths.

Long, long afterward, we stopped by a ray of light. It came from a felt

tent, or yurt, an official way station along the trail. We entered, wet and cold, and sat by its little but welcome central fire, while Turkomans in long, quilted robes and frizzly, furred caps made gestures of welcome in behalf of their Chinese superiors. There was much talking and activity. A great metal bowl filled with water was brought in and placed on the iron standards above the glowing fire of dried yak dung.

A bleating sheep was next dragged in. It was thrown to the floor in front of us, and its throat quickly cut with a long, sharp knife. Wooden bowls caught gushes of steaming

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1930 he was awarded the Speyer Memorial Prize in Sculpture. He is the author of *Trails of the Hunted* and is a contributor to many magazines. In 1942 and 1943 he served as Special Consultant, Army Air Forces Materiel Command, at Wright Field. He is responsible for the designing and construction of the American Museum's celebrated African and North American habitat exhibits.—ED.

IONS IN CENTRAL ASIA

By JAMES L. CLARK*
 Director of Preparation and Installation,
 The American Museum of Natural History

PHOTOGRAPHS BY MORDEN-CLARK EXPEDITION

◀ SOUTHERN GATEWAY TO CENTRAL ASIA: the Russian Pamirs, northwest of India. The photograph was taken at 15,000 feet, but the word "Pamirs" refers not to the mountains but to the high valleys. Into them come the nomads with their flocks for grazing through the summer. This is the land of the famous wild sheep, *Ovis poli*, or Marco Polo's sheep

▶ YOU CAN TRAVEL from about 190 miles east of Leningrad to within 390 miles of Vladivostok without ever finding a river that flows to the sea. What rivers there are in this vast interior basin either flow into salt lakes or dry up on the arid plains. Water is the major problem in the heart of Asia, as seen by the map below showing rainfall within the boundaries of this basin



blood. We were offered a drink, which we reluctantly sipped, in politeness. The sheep was rapidly and artfully skinned and cut up right before us, and chunk after chunk was cast into the cauldron. The odor of fresh blood was not pleasant.

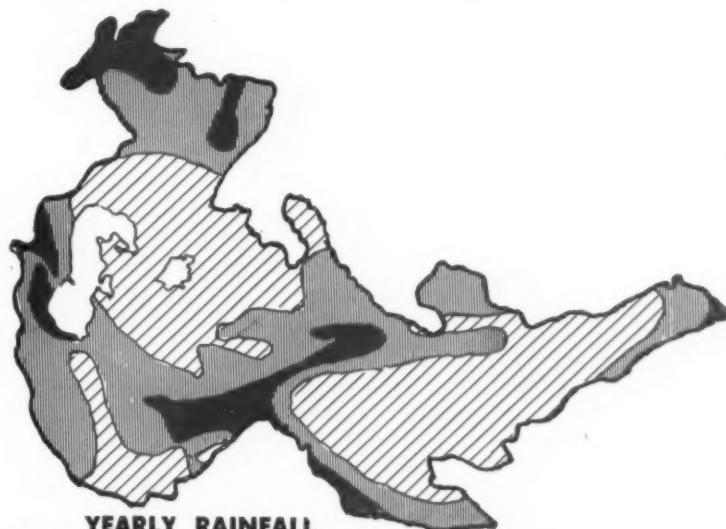
"What is this all about?" we asked of our own guide.

"In your honor, sirs," he replied. "The highest honor these people can pay you."

The light of the fire modeled the strong, brown faces of these mountainmen about us. Their long, maroon-colored coats, with sash about the middle, and baggy pantaloons tucked into the tops of sturdy leather boots, seemed to suit them well.

The framework of sticks and the thick felt covering of the yurt were stained brown with smoke. Chattels and articles of clothing hung on the latticed palings that supported the wall, while felt bedding and wooden chests lay scattered about the edges. Our hosts jabbered and smoked, as we sat courteously partaking of dried raisins, currants, almonds, and a native wine, while awaiting the real feast that was to come. Well could we have been with Marco Polo, for the centuries that had passed had brought not a single change to this dim and primitive setting of Central Asian hospitality.

This vast area, surrounded as it is



YEARLY RAINFALL
 ▨ Under 10 inches ■ 10 to 20 inches ■ Over 20 inches

by the "golden fringe" of the fabulously rich countries of China, Malaysia, India, and Persia, with immense expanses of steppe country to the west and Siberia to the north, has been, by its very geographical position, deprived of easy trade routes that might have brought to it the benefits of a more progressive outside world. Distances from within were too great for

its people to venture much beyond their own borders, and it was only by relays of caravans from without that foreign contacts were made at all. To the south lay the world's highest mountain wall, an effective barrier to intercourse with the prospering peoples around the Indian Ocean. To the north stretched Siberia, a land of primitive hunters, uninviting and with



▲ THE RECEPTION COMMITTEE of Kirghiz gentlemen who greeted the author on the Morden-Clark Expedition. Airplanes now bring western civilization to some of these remote sections, which a short while ago could only be reached by long and difficult travel on horseback. Note the lattice framework of this typical yurt or felt tent, whose construction is shown below

▼ TO MAKE THE FELT COVERING OF "munda," wool of sheep, goat, or camel is sprinkled with water and rolled up on a long pole. The ends of the pole are harnessed to a camel, and it is rolled over flat ground to entwine and compress the hair

▼ THE FRAMEWORK is collapsible, and the whole house can be transported on the backs of bullocks, camels, or yaks. The yurt is the nomad's home over most of Central Asia

▼ THE FELT COVERING is good insulation from the cold, so the dwelling is warm as well as roomy. For temporary stops, a shelter shaped like the Indian tepee is sometimes erected (*foreground*)

little to offer. Only from China and from Russia and the Near East were contacts at all possible, and then only after tediously long caravan journeys.

Protected thus by this ring of space, strife came to them from within rather than from without, and their tribal and religious wars were quite bad enough. It was here that the great hordes of horsemen of Attila, Tamerlane, and Genghis Khan surged back and forth, spreading terror and death while conquering all before them. These horsemen of the Huns, trained to sleep in the saddle and live off the land as they passed, ruled intermittently for centuries, safe from the dangers of invasion or defeat. They alone were able to move with such strength and swiftness that the foot armies of other peoples were no match for them.

Geographically, this vast area is a tableland divided through its center by the western end of the beautiful Tian Shan Mountains, rising to some 20,000 feet. To the east lies the Chinese territory of Sinkiang, sloping gradually to join the borders of the Mongolian Gobi and the western provinces of China. To the west, the steppe countries of the Tartars and Turkomans roll on to the Caspian Sea and the Ural Mountains.

Although the Chinese filtered through to this promised land as far

as the Tian Shan early in the third century, and possibly long before, and predominated as the most cultured class, they have only intermittently ruled it for something less than five centuries.

To Marco Polo came the first opportunity of penetrating this little-known land, while on his way to the silkened courts of China; and of its peoples and their secluded world he has very ably recounted.

It was still to remain unchanged, however, for there was nothing to alter the slow pace of the camels or shorten the distances they had to travel. There were no ships to come from across the sea, nor roads by which a more progressive civilization could gradually encroach upon them.

These people early took to irrigation above the banks of the rivers and at their very ends, where the silt-laden waters deposited great fans of deep and rich alluvial soil. Here they built their bazaar cities and trading centers and lived largely the life of agriculturists. In the more fertile valleys of the hill country, there were nomads and hunters. In the flat country, dust bowls and deserts stifled their progress, but they found a balance under which they could perpetuate themselves, if not grow.

Not until the latter part of the nineteenth century did infiltration





▲ **KALMUKS OF SINKIANG:** a strongly Mongoloid type of wholly nomadic people. The big switches of horsehair tied to her own locks show that the woman on the left is married; the other two are not. The Kalmuks are fine hunters and bring in the furs from the mountains. They are Buddhists



◀ **KALMUK CHILDREN** on the pasture lands of the Tian Shan

▼ **THE KALMUK WOMAN** in the center wears a switch of horsehair across her eyes, which in this case are probably weak or sore. Throughout Central Asia this primitive but effective method is used to protect the eyes from glaring snow. The Kalmuks number something under 200,000 and live in the uplands. Some of them have a fondness for appropriating the horses of other people



from without begin to change their future. In 1868 the Russians took serious interest in the potentialities of the region and moved down with their armies. Many hard battles were fought before the last great oasis city of Samarkand finally fell under their dominion, which gave them control of the whole western area up to the Chinese Tian Shan.

Europeans now became interested, and courageous explorers ventured in over long and wearisome routes to study the land and its people. With their protective belt of vastness penetrated, their isolation began to wane, but their mode and tempo of life followed the same pattern as it did in Biblical times.

Not until World War II, which has left no portion of the globe untouched, did Central Asia really become conscious of any change. Now its people, in parts at least, shaken violently from their ancient slumber, are becoming a part of our world. Now vast changes are beginning to take place. All of Asia is awakened—aroused and quickened by the reverberations of war.

Ancient caravan routes have become highways. Fleets of heavily laden trucks now speed across the old silk routes in clouds of dust, doing in a day what the caravans did in a month. On the Russian side, railroads are reaching their tentacles ever farther, and planes shorten months into hours. Central Asia is now shrinking with the rest of our world. The change has come upon it with a sharp crescendo in the last two or three years.

The transition is not a slow one. These people are being swept right off their feet and, dazed by it all, are no doubt wondering what it is all about. Gradually they will adjust themselves, for many are of a sturdy and progressive type, who can and will accept a progress that will bring benefit to all. Development will be rapid, for everything that the outside world has to offer will be all new to them, and they will absorb it at a fast rate, in their old homes and new industries.

Education, which has had a good start under the Russians but somewhat less in the Chinese territory, is now expanding. The old and fiery religious antipathies, which have burned so deeply, will now wane, and more concerted action will result.

Since Russia took over the westernmost steppe countries, this area has

been politically divided on the maps as Russian and Chinese Turkestan. Sinkiang (the New Territory, as the Chinese prefer to call it), lying to the east, holds the still primitive bazaar cities of Khotan, Yarkand, Kashgar, Aksu, Karashahr, and Urumchi, its capital. In the Russian domain are the larger and somewhat more sophisticated cities of Samarkand, Tashkent, Bokhara, and the lesser ones of Andyan, Verny, and Kuldja. A few years before the present war, the Soviet Union through intrigue, was successful in extending its political influence into Sinkiang, but recently, by a most promising gesture of good faith toward mankind, it has returned complete control to the Chinese.

To this newly opened land, trade will flow from Russia, from Siberia, and from China. The great barrier wall to the south, more effective than oceans or deserts, precludes even in modern times a free intercourse in this direction.

Specialists, engineers, and technicians of many kinds and from many lands, will be needed for vast new enterprises in road building, hydroelectric power and irrigation projects, mining, large-scale agricultural developments, and many other activities, for it is wide open for all modern improvements and the benefits they offer. Now, with but a few million people, there is room for many more. Good and sturdy labor is already at hand, and the people will serve well to enjoy a prosperity never before known to them.

When the development of this new land joins with the potentialities of Russia, Siberia, and China, there will come into being one compact sphere of influence with resources so varied and extensive as to stagger the imagination.

But for the present, water is the sad story and will continue to be for some time. No rivers that flow from within this whole great area ever reach the sea. Waters that are not sapped for irrigation finally dissipate themselves into thirsty sands. Engineers can and will remedy the water shortage by going back in the mountains where there is an unlimited supply from perpetual snows. They will dam the deep gorges for power and irrigation projects. When this is done, great areas of arid waste will become lands of plenty. New industries, with raw materials and power at hand, will bring progress and wealth.



◀ A KIRGHIZ HUNTER with matchlock rifle and forked rest. The Kirghiz are a herding people of the mountains in Southwestern Sinkiang. They are quite Mongoloid but are Mohammedans

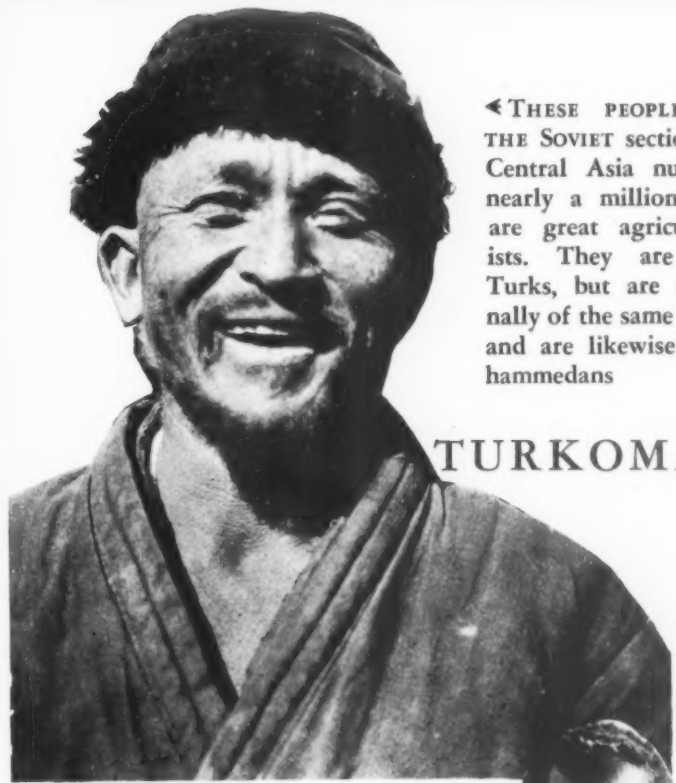
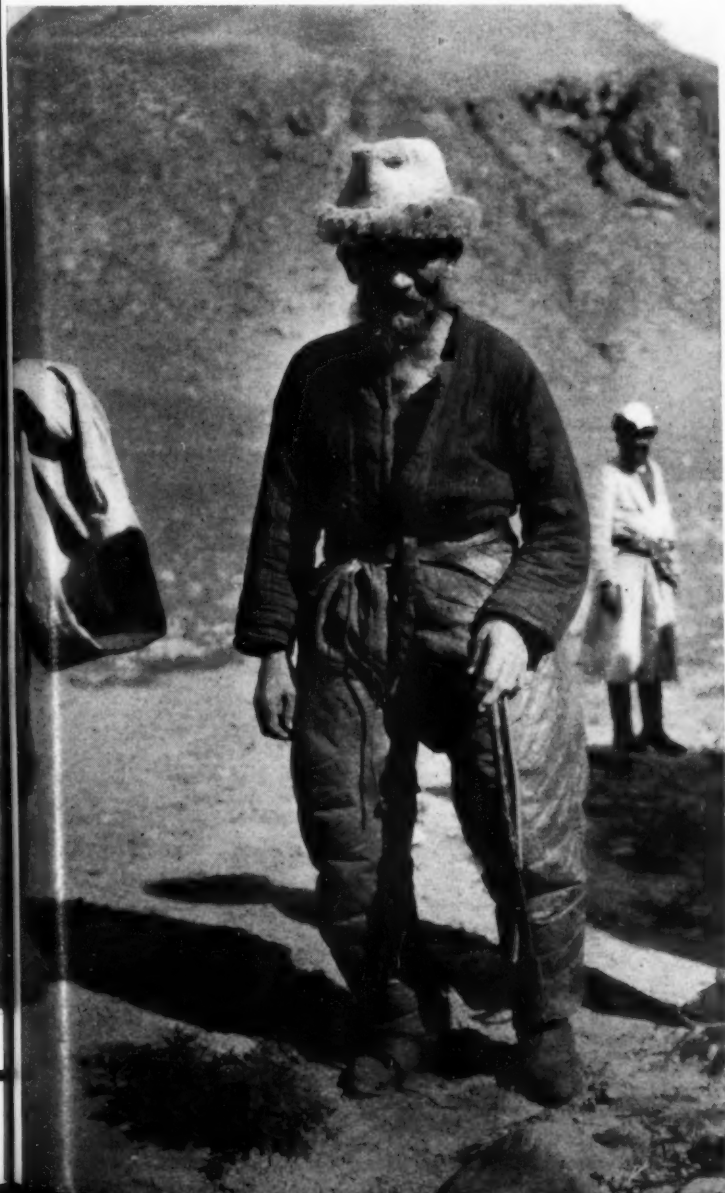
▶ TYPICAL of the Chinese ruling class is this Amban (magistrate) of the walled city of Karasha, Sinkiang. The Chinese of Sinkiang number some 200,000 and predominate also as merchants

▼ A KAZAK FAMILY in the Tian Shan. While the men are out hunting or herding the cattle and horses, the women do chores at the camp. Children herd the sheep and goats near-by. The Kazaks number about 800,000. Some of them live in Sinkiang, but most are in Soviet territory to the west





▼ THE EXPEDITION'S KAZAK HUNTER, "Tulabai," of the Tian Shan. The Kazaks are nomads and live in the grasslands of the higher country. They are only slightly Mongoloid in appearance. Many have light skin and blue eyes



◀ THESE PEOPLE OF THE SOVIET section of Central Asia number nearly a million and are great agriculturists. They are not Turks, but are originally of the same stock and are likewise Mohammedans

TURKOMANS

▶ A TURKOMAN WATER PEDDLER of Kashgar, the center of the Turkoman area in Sinkiang



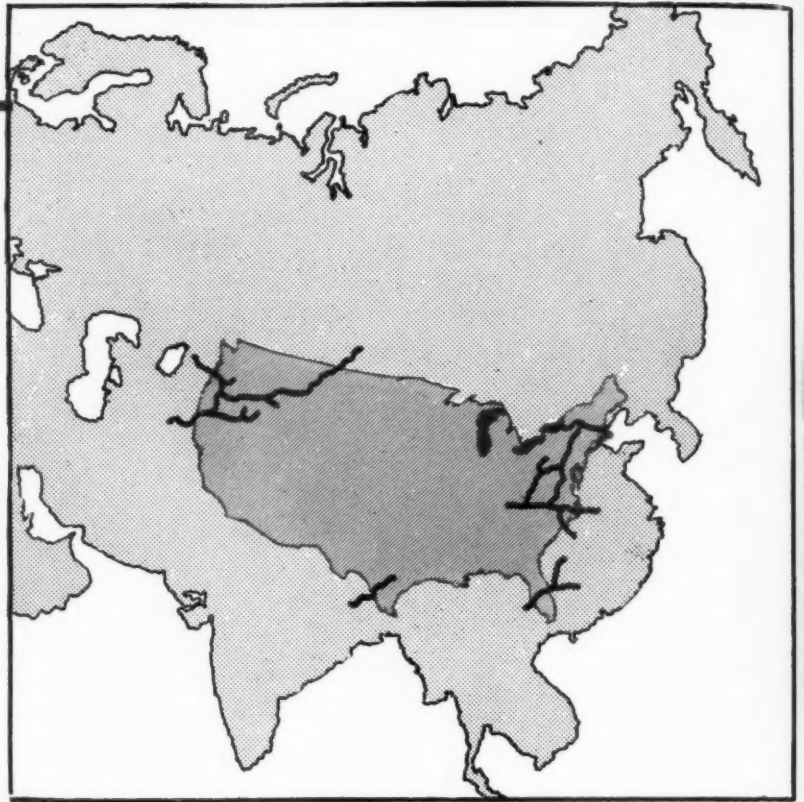
▼ TURKI WOMEN AND CHILDREN of Sinkiang. They have straight black hair, and many are attractive. Their garments, either homespun or procured through trade, are cotton cloth



TRANSPORTATION



➤ THIS VAST SECTION of Asia the size of the United States has almost no railroads. Many people in it will make their acquaintance with the airplane long before they see a locomotive or automobile



▲ A MONGOLIAN DANDY on his well-bred camel. These riding camels travel at a much faster rate than the ordinary freight camels and are sometimes referred to as express camels

Some of the larger, strictly desert wastes must remain as such for a long time, but they may eventually prove to hold their potential wealth below the ground instead of on its surface.

As regards minerals, the whole region is untouched, yet many resources are known to exist there. Coal is mined from shallow shafts, and oil is already taken and crudely refined from surface wells, with indications that it is present in vast quantities.

Much of the country will remain as grazing lands, for there is much rich pasture. Lying in the same latitudes as the United States, the temperate climate has produced in the valleys some marvelous grasslands, where the Kazaks and Kulmuks already raise

fine horses, cattle, sheep, and goats.

Unfortunately the Asiatic is hard on forests, for he is forever cutting down but not planting; and the first thing that Central Asia must be taught is conservation. There still remain in the Tian Shan stands of fine big spruce, some five feet in diameter. But these are only a fraction of the timber that once covered large areas. Evidence shows that many of the now barren grass stretches were once entirely forest grown; but fires, which burn unchecked and sometimes are set by natives for reasons unknown, are rapidly reducing what is left.

Here in this temperate belt is enjoyed the same healthy, invigorating

climate as our own, in which a great majority of man's food supplies can be produced. Varying altitudes and soils provide a wide range for both food and industrial crops.

As a field for research in natural science, Central Asia is as yet quite virgin territory. Here we may find, in fossil form, remains of earliest man.

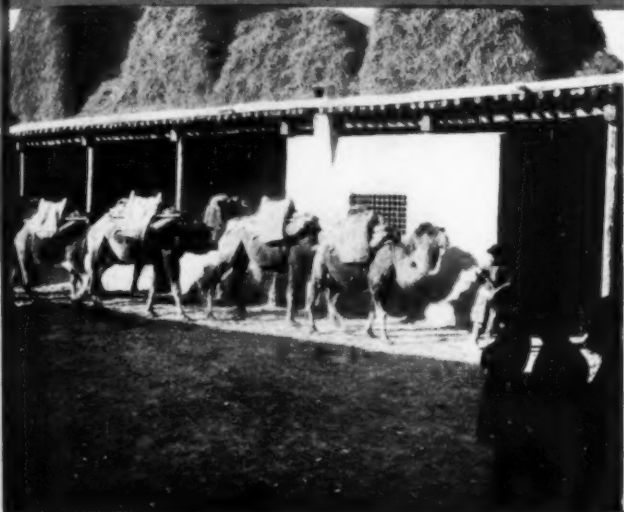
Now that there is come to the New Territory of Sinkiang and Russian Tartary a younger and more progressive group of Chinese and Russians, educated and trained in agricultural, industrial, and governmental affairs, this long-dormant land can look forward to an unbounded period of progress and prosperity. A real future lies before it.

▼ THE SHIPS OF THE DESERT take on water at widely spaced wells. In much of the flat desert country, water can be found eight or ten feet below the surface. When it is brought up, it is emptied into shallow enclosures where many heads can be watered at one time

▼ THE OPENING TO THE SHALLOW WELL and the vessels with which the water is bailed out can be seen in the foreground



▼ A CAMEL TRAIN with pack saddles waiting to be loaded. The hay stacks are piled atop the roof of the compound, safely out of reach of the ever hungry beasts of burden



▼ CAMEL TRAINS that carry freight up to 600 pounds to a camel travel day and night, winter and summer. In the extremely low temperatures they increase their average of two-and-one-half miles an hour to three



▼ OCCASIONALLY CARAVANS encounter difficult and dangerous going. Here the natives are helping one of their loaded beasts across a treacherous river flowing from the mountain gorges



▲ THE FAST EXPRESS OF CENTRAL ASIA: *telagas* drawn by three horses. These little wagons carry the mail, light articles, and a few passengers. The horses are kept at a trot and frequently changed. These four carts with the same horses made 150 miles in three days with the expedition's baggage



▲ HEAVY FREIGHTING is done by the Chinese with primitive carts. The heavy wheels (here being repaired) have a stationary axle, and the load is carried in a bathtub-shaped basket. A single bullock draws each cart. These carts travel mostly in the cool of the night, and frequently 100 or more of them move in a group, presumably for protection from bandits



▲ THE INDIANS "TRAVOIS" in Central Asia. These wheelless conveyances are mostly used for hauling hay from the fields



▲ FINE GRASS LANDS and timbered slopes are found in the valleys of the Tian Shan Mountains. Here in an area as large, as fertile, and as beautiful as Switzerland a great many people can live in health, happiness, and prosperity, for the country has everything

▲ (Upper right) THE WELL-WATERED TEKES VALLEY in the Tian Shan Mountains abounds in rich pastoral land, but trails, bridges, and other facilities for travel are primitive

GRAZING LAND



▲ KAZAK HORSEMEN in the grazing country of the Tian Shan. The Kazaks are nomads and have great herds of horses, as well as cattle and sheep. They ferment mare's milk and make kumiss, which is used as an intoxicating beverage

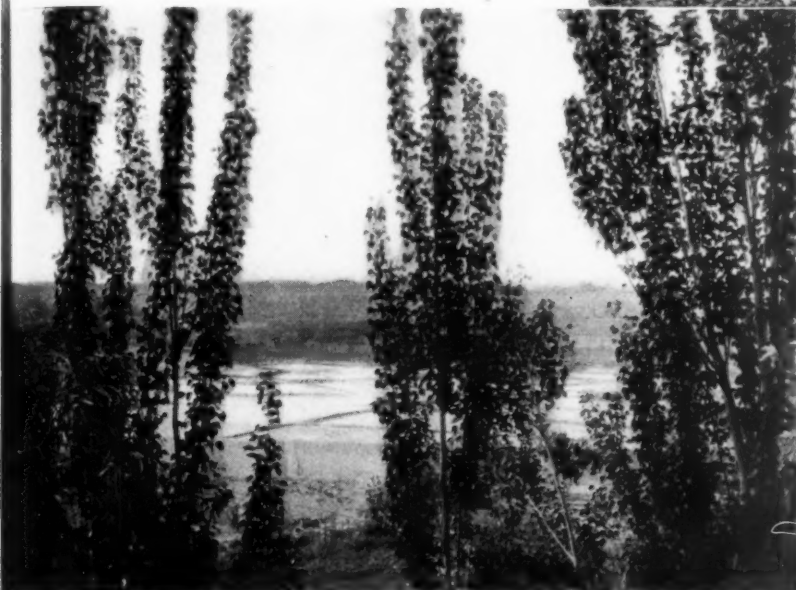
▼ KALMUK CHILDREN of the Eastern Tian Shan on their riding bullocks, on which they follow the herds of sheep and goats during the sunlight hours

▼ AMID UNSURPASSED ALPINE scenery these Kazaks likewise perform the duties of the herdsman on the backs of bullocks

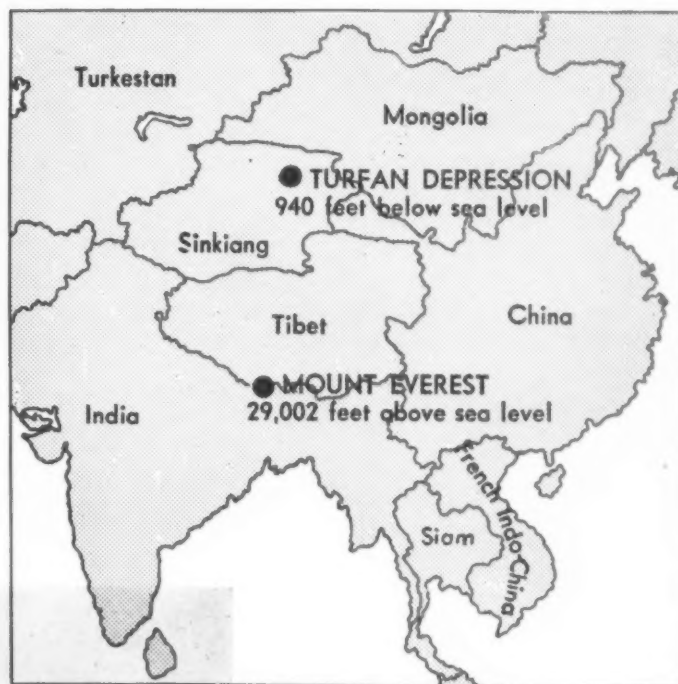


➤ OUTSIDE THE WALLS of Kashgar, the farmers grow their garden crops between irrigated ditches laid lengthwise through their fields

▼ A VIEW SHOWING only a part of the rich irrigated fields around Kashgar, a city of some 80,000 inhabitants. The Kashgar River flows through an area of about 2500 square miles that is largely made up of windblown soil, or loess. In the center of the city a very large spring of clear water flows from the earth and is properly protected and guarded from contamination



➤ THE TURFAN DEPRESSION is a flat, arid basin that reaches a depth of about 940 feet below sea level at the lowest point. It is 1000 miles almost due north of the world's highest mountain



◀ PRIMITIVE METHODS of tilling the soil linger. Here is shown a native with his bullocks drawing an all-wood plow in the great Turfan Depression



◀ THESE CANYONS in the mountains flanking the plains could be dammed and stored with permanent water for irrigating the sections suitable to agriculture

➤ THIS VIEW IS TYPICAL of the flat, arid plains that cover much of Central Asia. Water would transform some of them into great agricultural areas, and they may prove to be even richer beneath the surface, in minerals or oil



▼ THE NATIVES have appropriately called this area "Trees of Rock" (Kargai Tash). Its interesting topographic features remind one of arid mountain sections in our own West





▲ A DONKEY CARAVAN stops for a rest in a grassy valley of the Tian Shan. Much of this beautiful and fertile country, now utilized only for grazing, is potentially valuable for many other uses

➤ A SWEEPING VALLEY that would satisfy the eye of anyone seeking mountain scenery. To the left can be seen a flock of sheep



◀ A CAMPSITE along the route of the Morden-Clark Expedition, in the big spruces of the Tian Shan. Abundant wood, water, and grass make this area perhaps the biggest and best garden spot in Central Asia



▲ TYPICAL OF the bazaar cities of Central Asia are these little shops or stalls of Kashgar, in which the vendors spread their goods

wherever traffic will permit. Melons, grapes, apricots, pears, and apples are sold here, as well as dried fruits and almonds

KASHGAR

▼ MARKET DAY. This city in the southwest corner of Sinkiang is inhabited almost entirely by Turkomans. The brushwood greens shield the narrow streets from the intense heat of the summer sun



▲ THE HOME OF THE BRITISH CONSUL in Kashgar. Only foreign officials have such pretentious habitations



▲ THE CITIES are built of sundried brick over a structure of beams and sticks. A view looking over the housetops of Kashgar

► BIG TREES shade the adobe houses of the city's "residential" section. Ladies and gentlemen of the better class ride their donkeys while shopping. The very wealthy ride in their closed *mappas*, highly decorated carts of the elite



◀ DONKEYS are the typical carriers on Kashgar's boulevards and byways





▲ THE LITTLE CHINESE military post of Shutta lies in the Tekes Valley of the Tian Shan and controls this area close to the Soviet border. Remnants can be seen of a magnificent forest, which once covered all these hills. Although the slopes are now turned into grassland, erosion will soon start to wash away the rich soil

◀ RESIDENCE of the Chinese Amban, or magistrate, of Karasha. It is customary in this region to build around a yard or compound, which is entered through a gateway from the street



▲ AN OPEN-AIR RESTAURANT in the streets of Urumchi. Eating places of this sort are typical of the Chinese cities and are always well patronized

► THE GREAT WALL around Urumchi here separates some residences and gardens from the domain of the "outcasts" outside the enclosure



◀ THE MAIN GATEWAY to the city of Urumchi, seen from within. The architectural pattern of these inland cities, like the tempo of life in them, is linked closely to the days of Marco Polo. But the era may not be far off when visitors will be whisked through this ancient portal from the local airport

nature

through the
CAMERAS

▼ Crab Spider and Fly

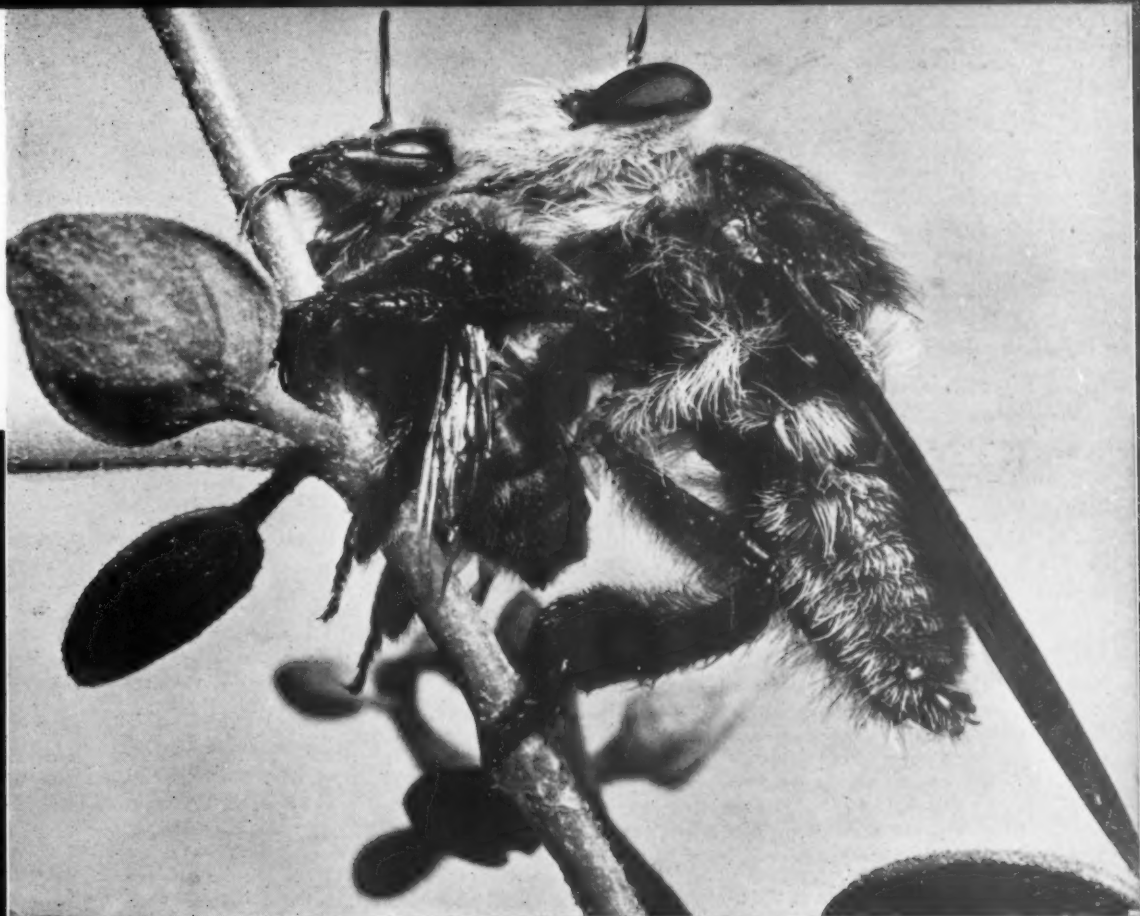
Three



Three insects with their prey

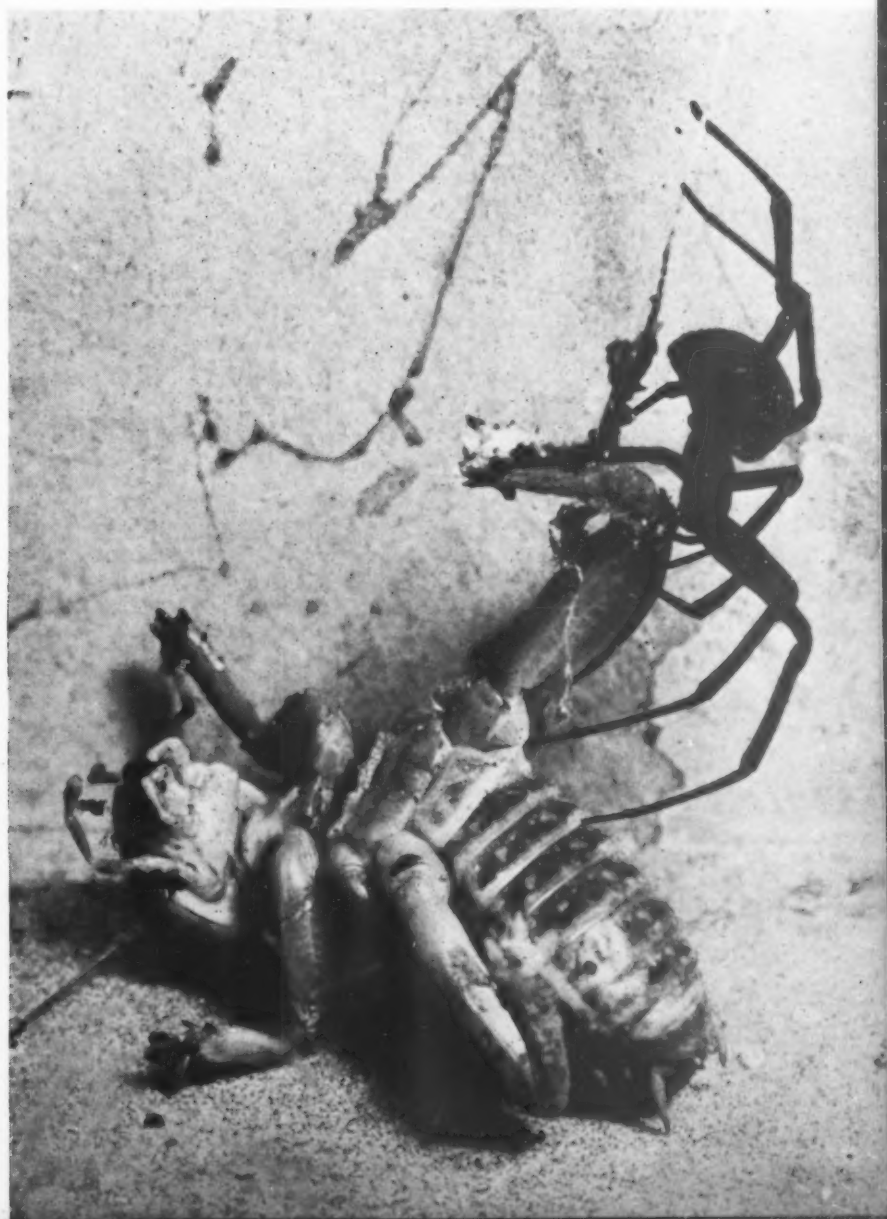
AS EYE

By RICHARD L. CASSELL



▲ Robber Fly and Honey Bee

▼ Black Widow Spider and Jerusalem cricket





By **THANE L. BIERWERT**
*Acting Chief, Division of Photography,
 The American Museum of Natural History*

TRAMP, tramp, tramp, the photographers are marching from store to store, searching for a roll of film or a sheet of paper. It's a great day when they find something in stock. And we have been warned that the situation will become steadily worse.

The important thing today is to hit every exposure squarely. Gone are the days of shooting twelve in order to get one good picture. You can't hike from store to store all the time. Remember that good shoe-leather is among the missing, too.

Suppose you do run across some film. Do you know how to make every exposure good? Improve your methods by carefully analyzing each subject. The old "by-guess and by-gosh" technique is too haphazard. Use your notebook and pencil again, as you did in the beginning days of your photographic hobby. If you have already mastered your technique, that is, if you know how your equipment operates, how your favorite film is exposed, and what you can photograph best, then you will have few difficulties. However, not all of us are so fortunate. Here is what can be done to conserve film and still have many pictures.

We should resolve to make no landscape or pictorial exposures if there is a possibility that we can return to the area at a more propitious time. If you must expose, diligently consult the exposure guides that come with the film. If possible, use a precise exposure meter, taking care to measure only the light in the sections of the picture that are most important. Even then, check the meter reading against the exposure guides to catch any slip on your part. Before making the exposure, be certain that your viewpoint is the best possible for the scene. Make only one exposure, whether you have color or black-and-white film.

When you have a new baby in the house, or if you are making pictures of the family to send to a man overseas, it is imperative that every exposure count. The way to get good exposures is by having enough light to work with, ensuring short exposures that will stop movement of the subject. Sunlight makes for short exposures, but we cannot have it every day, and we cannot move it around very easily if we wish to vary the direction of the lighting. However, we can use "canned sunshine," in the form of flash bulbs. Fortunately these are

procurable once again. If a few simple rules are followed, every exposure can be correct. It is then merely a matter of exposing at the crucial moment.

Correct exposures are possible because we are working with known elements: (1) the film has a definite emulsion speed or rating; (2) each flash bulb has a uniform brightness and duration, and (3) we work at measurable distances. With these three factors we are able to find our unknown quantity, the exposure. In order to understand how flash bulbs can guarantee good exposures, let us follow the steps in an example.

Flash bulbs can be used on ordinary house current, unless marked otherwise, and they have a flash duration of about one-fiftieth of a second. A flash synchronizer is not necessary for flash pictures; "open flash" pictures are possible indoors with every camera. They are taken by opening the shutter on "bulb," setting off the flash with the other hand, and then closing the shutter. Buy several G. E. 22's or Wabash "Press 40's." These are medium-size bulbs with a retail price of 11 to 18 cents. They can be used in a gooseneck desk lamp or a photoflood reflector, as can most of the smaller or larger bulbs. Make certain that the switch is in the off position when inserting the bulb. A searing burn results if the hand is on the bulb during a flash.

Our subject is a year-old, lively youngster, never in one place for long. Have him stand on a chair holding on to the back for support; this confines him to one spot. The chair should be placed a few feet from a background of your own choosing. Set up the camera on your tripod about five or six feet from the subject. Use the flash bulb in a reflector near the camera, slightly above and to one side of the camera, the location for soft modeling. This will mean that the flash bulb will be six feet away from the subject. Verichrome or Plenachrome film, whose speed rating is G. E. 32 or Weston 24, is in the camera. We are ready to compute the exposure for this set-up and capture on the film a good likeness of our "wild animal."

The manufacturers of flash bulbs supply data sheets which can be picked up from the literature rack in your dealer's store. On the sheet are charts similar to the one illustrated. As mentioned before, we find our exposure from known quantities. A correlation of film speed with the flash bulb used results in a *flash ex-*

posure guide number, which remains constant as long as we continue to use this same film and same bulb. This flash exposure guide number is used to determine the proper lens aperture for a selected shutter speed. In this case we are using an "open flash," which is the equivalent of a 1/50 second shutter speed, because that is the duration of the flash. The lens aperture is found by dividing the guide number by the distance in feet from flash bulb to subject, six in this case. Our mathematical steps then are quite simple. The film rating is G. E. 32 or Weston 24. The bulb used is "Press 40." The exposure is to be an "open flash." Dividing 210 (the proper exposure guide number) by six (the distance in feet), we get f:32, the correct lens aperture for this home studio arrangement. Our exposure is therefore "open flash" at f:32. Result, perfect negative.

The procedure is to work in normal living room illumination, waiting for a good expression to come. In one hand we hold the cable release ready to make a bulb exposure. In the other we hold the reflector switch ready to flash the bulb while the lens is open. The room light will be so weak in comparison with the brilliant flash that the camera shutter can be open for a second or more without having an image register on the film.

It is a simple matter to compute flash exposures for faster films or for synchronizers by using this exposure guide method. The main point to remember is that the guide number is divided by the distance in feet from the flash bulb to the subject, regardless of the camera location, be it six feet or sixty feet from the subject.

As with so many things, the technical end can be solved. The human element rests entirely with the individual who operates. If you can flash the bulb at the instant of best expression, the flash will preserve that moment for you with the least waste of film.

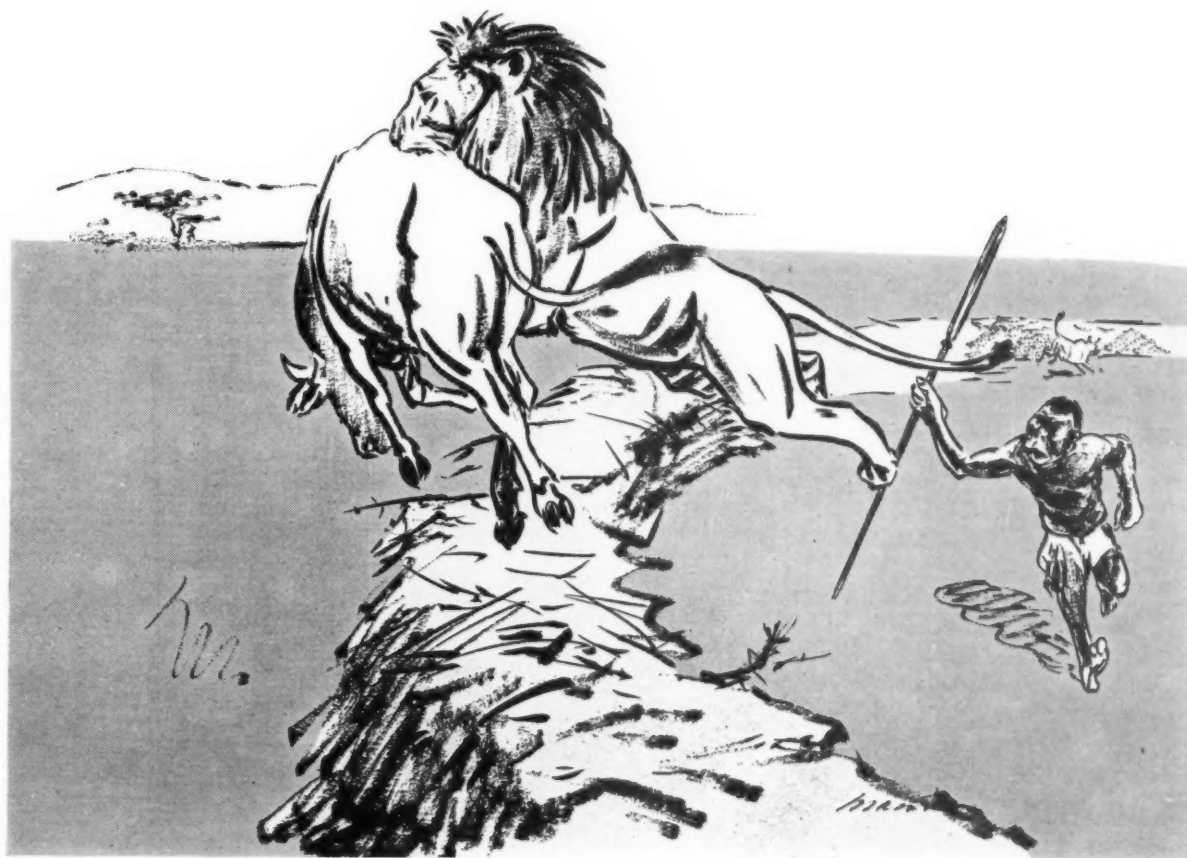
Flash bulbs may seem to be an expensive way to make photographs, but on close analysis the cost is not at all great when you can consistently produce the pictures.

If readers of NATURAL HISTORY have specific questions regarding photography in the realm of natural history or science, we shall be happy to try to answer them.—ED.

FLASH EXPOSURE GUIDE NUMBERS

Film Speed		Shutter Speed	"Press 40" Guide Number
G.E.	Weston		
32	24	Open Flash	210
		1/50 (synchronized)	210
		1/100 (synchronized)	180
100	64	Open Flash	340
		1/50 (synchronized)	340
		1/100 (synchronized)	290

STRENGTH OF LIONS



By JOHN ERIC HILL
Drawing by
G. FREDERICK MASON

THE event on which this cartoon is based took place in the Masai country of East Africa.¹ The natives here count their wealth and importance in their cattle, but these are a great temptation to the lions of the region. To protect their herds from these great cats the Africans build *bomas*, walls of thorn brush piled six or seven feet high, around their huts, thereby enclosing a space for their animals. When night falls the cattle are driven in and the entrance is closed by thorn brush like the rest of the *boma*. The herdsman and his cattle pass the hours of darkness behind this barbed entanglement. As a rule this keeps lions out, for they are afraid of getting thorns in their sensitive feet, but sometimes one of them, more daring and powerful than his fellows, makes off with an animal in spite of all precautions.

The man was sleeping inside his

hut when he heard two lions outside his *boma*. The cattle huddled together on one side of the compound, terrified by the lions. Picking up his spear, the herdsman ran out between his stock and the danger; although one man with a spear is no match for a lion, the big cats can sometimes be driven off by a brave front. A splendid young lion leaped in over the barrier. The native could not bluff him and dared not close with him in unequal battle, but was forced to watch while the lion quickly killed a young animal, seized it in his jaws, and jumped back over the *boma*. Thus far, the story depends on the evidence of the Masai herdsman, but there was no other way for the lion to have carried off the bullock. The lion, his companion, and the victim were trailed the next morning by Dr. James L. Clark and Mr. William Leigh and were found two miles from the raided *boma*. The cow was larger than the lion and must have weighed nearly as much.

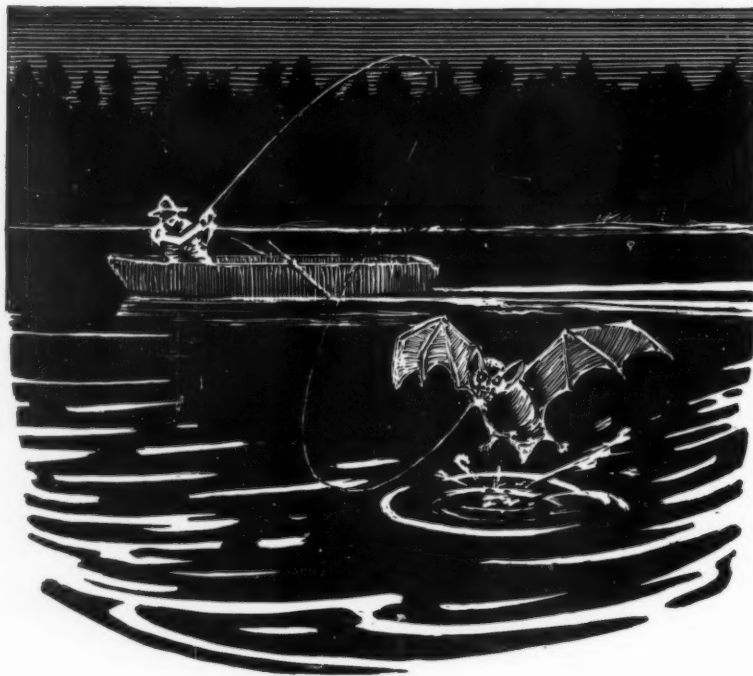
Other great cats perform feats of strength that are equally astonishing. A tiger is known to have swum across

a river with a medium-size cow in its mouth. Another was watched while it dragged a half-grown buffalo up a steep river bank. This was the more difficult because the earth was soft and at each step the tiger sank deeply. Gaur are the largest of the cattle tribe, weighing up to a ton, yet a tiger dragged a large gaur more easily than several men could.

Leopards are only about a quarter of the weight of lions and tigers, but for their size they are quite as powerful. One, carrying in its mouth a ewe urial (a wild Indian sheep), sprang to the top of a ten-foot rock; and the sheep must have weighed nearly three-quarters as much as the cat. Another leopard, in Somaliland, leaped over the thorn fence around a native camp, seized a sheep, and jumped back out of the enclosure. Leopards often cache their kill in the crotch of a tree, out of reach of hyenas and other scavengers. How they get animals weighing almost as much as themselves up in a tree is a puzzle, but such animals as the Indian swamp deer, partly-grown hartebeest, and a large reed buck have been found high in trees.

¹See William R. Leigh's *Frontiers of Enchantment*. New York, 1938, Simon and Schuster.

Fishing for Bats



By C. R. PARTIK*

LAST August 29, after work, I rowed out on Lac Long, near Ste. Agathe Des Monts, Quebec, to cast a festive fly to the big trout that had begun to come in to inspect their spawning grounds and were rising to nothing in particular.

Among my Numbers 10 to 16 there was nothing that roused their interest, and I knew that further effort would be wasted. It was one of those rare early autumn evenings for which the Laurentian hills are famous, and I let the breeze take my boat where it might. The sun had disappeared over the purple hills and the shadows had crept across the lake when the boat halted near the mouth of the creek.

Presently in the waning light I noticed what looked like a small minnow wriggling to the surface; it was the last stage in the metamorphosis of the May fly (Plecoptera). The little creature's back split open immediately and from it emerged the now complete insect, ready to take to the air within a few seconds when its wings were fully straight.

Then from nowhere in the semi-darkness appeared a bat. Without hesitation it dove to the surface of the water, cleverly picked up the newborn insect, and disappeared.

I happened to have in my fly box

an excellent imitation of the May fly on a No. 10 hook. (This fly is known to fly fishing enthusiasts as Green Drake.) I put it on my leader, gave it a good coat of fat to make it float, and cast it about 20 feet from the boat.

Hardly had my artificial creation dropped on the water, and before I could twist my wrist enough to pull the fly under, the bat reappeared, picked it up, and was hooked. It made one or two attempts to get up into the air, but without success.

Slowly I retrieved my line to release the bat, being careful not to set the hook more than necessary; but by one last effort the creature freed itself and flew away.

I made several more casts in various directions. Every time the fly landed on the water, this or another bat was back. Only by close attention and immediate action could I prevent the creature from getting hooked. And I was reminded that, at least in this light, it would be wrong to say "as blind as a bat."

*Mr. C. R. PARTIK, a native of Quebec Province, lived for 20 years in the country north of the St. Lawrence River, where he says "the winters are really old-fashioned." He is one of the few persons who has succeeded in breeding and raising fishers (*Martes pennanti*).

Recently he has moved 50 miles south to be a little nearer civilization.—ED.

LETTERS

Continued from page 97

for the sake of protecting ships intending to discharge or take on cargo. Ascension Island and St. Helena, both in the South Atlantic, are also famous places for waves of this type. On one or more occasions in the past, practically all ships in the harbor of St. Helena have been wrecked by the unforeseen onset of such rollers. It is now known, however, how long the barometric waves require to travel from the latitude of Ascension to that of St. Helena, and cable or radio information gives sufficient warning to enable vessels in port to seek the safety of the open sea.

* * *

SIRS:

In a review of *Birds of the Central Pacific* in the November 1944 issue of *NATURAL HISTORY* the reviewer brings up the old question as to how the fairy tern, and other birds, manage to make the latest capture when there are already several small fish in the bill.

A possible explanation has occurred to me. The fish are held in the bird's bill by pressure between the tongue and the upper mandible, thus allowing the lower mandible to open without losing any of the fish.

Edmund Selous in *A Birdwatcher in the Shetlands* offers a different explanation in the case of the puffin. I do not have the book with me here but, if I remember correctly, he suggested that each fish, as it is caught, is moved to the back of the bill and held there by the sharp edges of the bill slightly cutting into the fish.

With many thanks for your most interesting magazine,

J. D'ARCH NORTHWOOD.

Okeechobee, Florida

* * *

SIRS:

Your magazine has come to me through the Maryland Academy of Sciences since 1939, and I find it very interesting.

I would like to ask you a question. Why is snow *white* rather than clear like ice? . . .

BEULAH MUMMA.

Waynesboro, Penna.

Snow is white because the light striking it is diffused by the many tiny crystals composing it. The individual crystals are transparent, but owing to their fineness they scatter the light when taken in the aggregate. For the same reason, clear ice becomes white when it is shaved. Similarly, glass or clear rock-candy when powdered becomes white like sugar or snow.

Red or pink snow of the Arctic regions is a different matter. The color is due to a tiny alga that lives on the surface of the snow.

CLYDE FISHER.

* * *

SIRS:

The following quotation is from a letter from my brother, who is stationed in Liberia. I would be very grateful if you

could identify the fish he describes and give me further information concerning it.

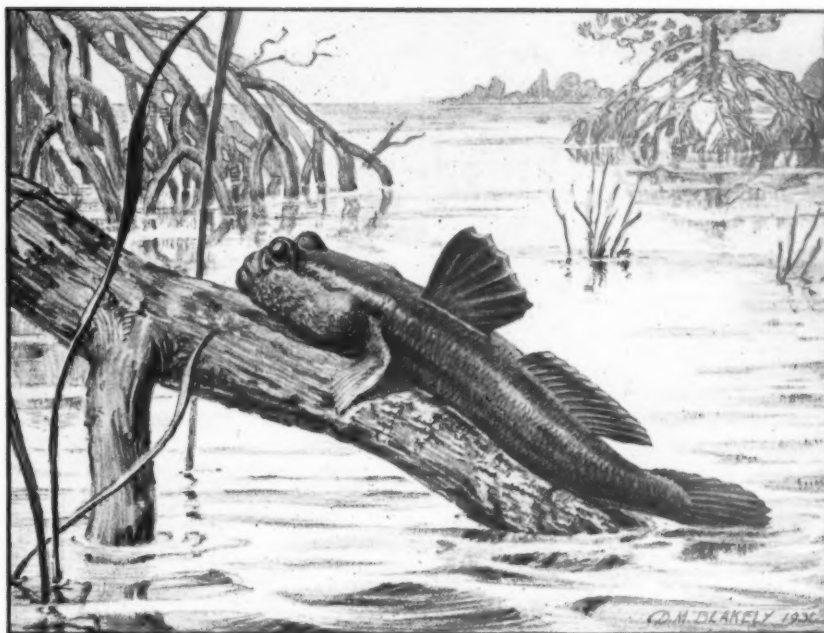
"Alighting from the canoe at a native village, we saw things move on the bank. I thought they were lizards, but Wray looked closer and said they were something he had seen in movies taken in Australia. . . . They varied from two to five inches in length and were shaped like a wedge. They had two reddish eyes set on a short stem above the head and two limbs more like fins than anything else, just behind the head. They used these as legs and hopped toad-fashion or crawled slowly. We couldn't catch any, because they all moved under the bank or into the water, but they wouldn't stay in the water long. We saw them quite close up, and Wray is sure they look like what he saw in the movies. Maybe you can find out for me what they are and what they are called. . . ."

JAMES L. JOWETT.

Norristown, Penna.

We are informed by the American Museum's Department of Fishes and Aquatic Biology that Mr. Jowett's brother in Liberia was observing the Mudskipper, *Periophthalmus*, probably *Periophthalmus koelreuteri* (Pallas). This fish is one of the Gobies and is famous for leaving the water and walking or hopping about on sand or mud in pursuit of food. It is found in tropical waters in the eastern Atlantic (West Africa) and the Indo-Pacific.

The late J. R. Norman in his *A History of Fishes*, page 79, says: "It chases its insect prey among weeds and rocks, and on land is quite as agile as many lizards. The pectoral fins are specially modified in relation to this habit, each being attached at the end of a kind of muscular arm, which can be moved backwards and forwards and is used exactly like a limb. Among other structural peculiarities designed to assist its progression on land, the low anal fin and the stout lower rays of the caudal may be noticed. Dr. Regan writes: 'When walking on the mud each step is accomplished by a forward movement of both pectoral fins, which are then put on the ground and draw the rest of the body after them; these steps are repeated rapidly, and as each results in an advance of about half an inch, very fair progress is made; the pelvic fins support the body during the turning forward of the pectorals. But, as their name implies, the Mudskippers often leap along the mud, or from one stone to another; short jumps may be accomplished by the action of the pectoral fins alone, but longer ones, which may be as much as a yard long, are made by a stroke of the tail. This is their way of getting along when they are in a hurry, and they may



▲ THE MUDSKIPPER, *Periophthalmus*, on mangrove roots. (See letter at left)

often be seen playing on the mud, jumping about in chase of each other."—ED.

SIRS:

May I express my appreciation for the articles on "Homes of the World" by Dr. Shapiro. This series alone is worth many times the annual membership dues.

INA CORINNE BROWN,

Professor of Social Anthropology.

Scarritt College for Christian Workers
Nashville, Tenn.

SIRS:

. . . I enjoy your Magazine more and more all the time. Everything about it is a joy—the pictures so beautiful, the paper so fine . . .

(Mrs.) J. WARREN CUTLER.

Rochester, New York

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BOOKS

Continued from page 101

have long needed the information brought to light by its author. It cannot, however, be said that they will receive with equal enthusiasm the cumbersome presentation of the record. Unfortunately the author apparently had little or no use for the refinements of archaeological technique. At least he betrayed no concern with them so far as the reading of this book reveals. Despite those defects, it will be indispensable to scholars.

H. L. S.


THE MURMUR OF WINGS

----- by Leonard Dubkin

Whittlesey House, McGraw-Hill Book Co., \$2.50
14 illus., 167 pages

OF books on birds there seems never a scarcity, nor are they all cast in one mold. Many are meant to teach the novice to call each species by its proper name. But

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the impact of wings on human personality brings out many another response.

Leonard Dubkin dreamed from boyhood of writing a book about birds. His schoolmate Berny felt confident at first of making his fortune out of bird study. The need of paid employment, however, pushed Leonard into journalism and publicity, while Berny forsook birds for Hollywood, where subconsciously he put birds and more birds into films. Leonard continued to watch his favorites from Chicago windows and bridges.

Psychoanalysis might help us to understand the book that Leonard Dubkin finally brought forth. Yet it is amusing without that effort. If one wishes to learn more about birds, even those of a great city like Chicago, he need not try here; but if he likes to look into the minds of people who are attracted by birds, then there is good fun packed between its covers.

The birds discussed are those that cannot escape notice: pigeons, gulls, grackles, starlings, and sparrows. Others get scant mention. People's reactions to birds, or their attitude toward their neighbors who are positively ornithotropic, are wittily dissected. The confirmed "bird lover" who writes indignant letters to the newspapers, or who tempts birds to linger overlong at his northern feeding station, is the person Dubkin likes least. He has more sympathy for the schoolboys who stamp the life out of a crow because they thought it laughed at them. Strangely enough, the author has overlooked the professional ornithologists, whose acquaintance he disdains. If he contemplated another book he might do well to extend his studies to that neglected corner of his field.

JAMES P. CHAPIN.

THE WORLD AND MAN AS SCIENCE SEES THEM

- - Edited by Forest Ray Moulton

Garden City Publishing Company, \$1.98
178 illus., 533 pages

THIS is a Garden City reprint of the book originally published by the University of Chicago Press in 1937. The passage of a few years has not made the work out-of-date, and it is a pleasure again to recommend it and to hope that this issue will reach a still wider audience.

The book is a compendium of science for the intelligent layman. I know of no better or more authoritative work in its important and useful field. A certain unevenness in style is the inevitable outcome of the fact that the work is so authoritative, each of the eleven chapters being written by a specialist in one particular branch of science. Indeed, the different methods of exposition add a certain pleasing variety that tends to sustain interest.

The subjects covered are astronomy, historical geology, atomic physics, chemistry, and various aspects of biology; the nature and origin of life, plant evolution and reproduction, invertebrate behavior, vertebrate evolution, physiology, microbiology, and racial anthropology. The reader who wishes to dip into the volume

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thus has a fascinating choice of topics, although it must be admitted that a really well-rounded treatment of the subject stated in the title is not achieved. For instance that part of physics most truly pertinent to our daily lives is omitted (a fault of most recent popularizations of this science), and so are such highly important aspects of the world and man as heredity, psychology, and social anthropology. In contrast, such relatively abstruse or remote problems as wave mechanics, the evolution of sex in plants, and learning in protozoans are treated in some detail.

G. G. S.

THE GREEN CONTINENT

A Comprehensive View of Latin America

By Its Leading Writers

- - Selected and Edited by Germán Arciniegas

Translated from the Spanish and Portuguese by Harriet de Onís and Others

Alfred A. Knopf, \$3.50, 533 pages

AGAINST the general "good will" background of the moment, the book *The Green Continent*, skillfully edited and co-ordinated by Germán Arciniegas, and translated by Harriet de Onís and others, stands out like a true oasis, not a mirage, in the desert lands of mutual hemispheric ignorance. Here in some 500 pages are presented selections from the best writings of 33 authors, all citizens of the variegated southern nations too often indiscriminately lumped under the phrase "Latin America." In these pages, none of which were written for any immediate or propagandistic purpose, there is presented a sample, in vivid English, of the rich and complex physical and intellectual worlds of Mexico, Central America, and South America as seen and interpreted by their own people.

For the North American reader who, like the reviewer, is no linguist, but wishes to know what our southern neighbors actually are like, here is an introductory key. "Landscape and the Man" gives a firsthand view of the variant southern lands, their incredible beauties and rigors; "The March of Time," the Colonial background; "Bronzes and Marbles," the continuing fight for freedom, physical and intellectual; "The Cities," the background, charm, and modern significance of Rio de Janeiro, Buenos Aires, Mexico City, Lima, and Cartagena; and, "The Color of Life," the human atmosphere of racially and culturally complex but vitally important civilizations. Each section includes several authors, who write intimately on the basis of intimate knowledge. Each deals with geography and the past in such a way that the human present stands forth in clarity and the future assumes vital challenge. We can only hope that some of the translations of North American literature now being made in Spanish and Portuguese share in part the vividness and reality of the book under review.

WM. DUNCAN STRONG.

BOOKS

First . . .

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away, so small and so quick on the wing that she seems to disappear in the air.

After stocking the burrow with 15 to 20 or more aphids, she lays an egg among them. Then she walls off that portion of her burrow with bits of pith and begins to provision a new compartment above the first. So she continues to supply as many as six or eight separate cells in a single stem. If we were to split a stem containing a nest of *Stigmus*, it is likely we would find the larva on the ground floor full-grown while the upper story tenant was not yet hatched from the egg. Sometimes one or two rooms will be deserted and the aphid stock dried and brown, with no sign of egg or larva. Apparently the mother wasp simply failed to lay an egg.

The larvae are at first curled, gray, covered with white spots. After the larder has been emptied, the larva straightens to become the bright yellow prepupa and later the yellow pupa. It gradually turns black before the emergence of the black, winged adult.

Unlike the subversive tactics of the parasite or the kidnapping technique of *Stigmus* are the frankly predatory activities of the larvae of a syrphid fly and the aphid lions or larvae of lacewings, as well as both larvae and adults of ladybird beetles.

The syrphids, also known as flower flies and hover flies, have peculiar children. They are legless larvae, greenish marked with brown. The hind part of the body is broad, while the fore part is slender, tapering, and extensible. As they crawl slowly about on the leaf, they wave the front part of the body from side to side, stretching it out and again retracting it. When one of them encounters an aphid, it grasps the prey with its mouth hooks and, extending its forepart upward, holds aloft the hapless aphid. The aphid may struggle, waving its legs in the air, but to no avail, for it cannot reach the leaf surface or anything else. While held thus in the air the aphid is drained of its body juices and soft parts by the syrphid larva. Then the dry remains are cast away, and a new victim is sought.

When mature, the syrphid larva pupates in a hard brown puparium (the last larval skin) firmly attached to the sunflower stem or hidden in

a curl of the leaf. Usually in due course a yellow and black syrphid fly emerges. Sometimes, instead of the expected fly, a red and black ichneumonid wasp cuts its way out. Few, indeed, are the insect species free from the attacks of such parasites.

"Golden eyes" and "green lacewing" are common names for *Chrysopa*, and these names are appropriate to the dainty beauty of the adult, but aphid lion is the most fitting name for the larva. On the sunflower leaf that we have been observing, there are no lacewing eggs, but they may be found elsewhere on the plant. Each tiny white egg is fixed to the top of a hair-thin stalk nearly half an inch high. As each little pole-sitter hatches, it descends the stalk and sets out in search of prey. Aphid lions have disproportionately huge jaws and outspread legs, and the gray body tapers to the rear. Aphids so unfortunate as to be in the path of their prowling are quickly seized and sucked dry. When fully grown, the tiny brute rolls up in a spherical, tightly spun, silken cocoon which resembles a rather dull pearl. From the resting pupal stage in this cocoon the fragile, slender, green, lacy-winged adult emerges. The adults take no food; they rest by day beneath leaves and flutter about in the twilight and at night. They are possessed of a foul odor which may help to protect them from their enemies. Some species of green lacewings, however, appear to lack odor entirely.

But probably the most important of the aphid enemies are the ladybird beetles or ladybugs. So much has been written of these interesting insects

that we need describe them only briefly here. Commonest on the sunflower leaf is the convergent ladybird beetle (*Hippodamia convergens* Guérin). The adult is mostly red with small black spots. On the black prothorax are a pair of convergent white dashes which give it its name. In a general way the alligator-shaped larvae resemble aphid lions, but they are much more strikingly colored in their black dress spotted with orange. Unlike the lacewing, both adults and larvae feed on aphids, and they chew them up instead of merely sucking out the juices. It is said that one larva may eat as many as 25 aphids in one day, and one of its parents may consume 55. The eggs, like tiny, fat, yellow cigars standing on end, are laid in small clusters on the leaves and stem of our plant.

Adults of several other species of ladybird beetles are frequently seen on our plant and probably eat a small share of the aphids. A few larvae as well as adults of a species of *Scymnus* are found occasionally on the sunflower leaf. The adults are small blackish ladybird beetles. The larvae, however, are conspicuous among green aphids, for they are covered with long filaments of white wax. These larvae are ordinarily found among groups of mealy bugs, upon which they feed. Since mealy bugs are likewise covered with filaments of white wax, *Scymnus* larvae are very inconspicuous among them. There is no doubt, however, that the larvae on our plant were feeding on sunflower aphids.

As autumn approaches, our leaf becomes darker. Patches along its edges turn brown and die, and other parts where the aphids have been feeding curl somewhat. Finally the whole leaf becomes yellowish, then brown, as it dies.

Clearly the aphid colony is the center of activity on the sunflower leaf. Other colonies at other times are harassed by different parasites and predators not observed on this leaf. Yet unwilling hosts and defenseless prey though they be, they maintain the colony until cool weather and the gradual death of the plant, now in seed, drive away or kill the remaining individuals. Each aphid is a helpless atom; yet the colony is strong, for it fights back by simply producing more and more young. In the long run the victory is often the aphids', for some species become so abundant as to damage severely man's cherished crops.

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